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Report of the individual review of the annual submission of European Union submitted in 2013*

* In the symbol for this document, 2013 refers to the year in which the inventory was submitted, and not to the year of publication.

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I. Introduction and summary

1. This report covers the review of the 2013 annual submission of the European Union, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 30 September to 5 October 2013 in Brussels, Belgium, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Mr. Simon Eggleston (United Kingdom of Great Britain and Northern Ireland); energy – Mr. Eggleston; industrial processes and solvent and other product use – Ms. Maria Jose Lopez (Belgium); agriculture – Mr. Sorin Deaconu (Romania); land use, land-use change and forestry (LULUCF) – Mr. Markus Haakana (Finland); and waste – Ms. Mayra Rocha (Brazil). Mr. Eggleston and Ms. Rocha were the lead reviewers. The review was coordinated by Ms. Lisa Hanle (UNFCCC secretariat).

2. In accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol" (decision 22/CMP.1) (hereinafter referred to as the Article 8 review guidelines), a draft version of this report was communicated to the European Union, which provided comments that were considered and incorporated, as appropriate, into this final version of the report. All encouragements and recommendations in this report are for the next annual submission, unless otherwise specified. The expert review team (ERT) notes that the 2012 annual review report of the European Union was published after the submission of the 2013 annual submission.

3. In 2011, the main greenhouse gas (GHG) in the European Union was carbon dioxide (CO_2), accounting for 82.7 per cent of total GHG emissions[1] expressed in CO_2 equivalent (CO_2 eq), followed by methane (CH_4) (7.9 per cent) and nitrous oxide (N_2O) (7.2 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 2.2 per cent of the overall GHG emissions in the country. The ERT notes that potential emissions, instead of actual emissions, are used for one member State (see para. 45 below). The energy sector accounted for 79.8 per cent of total GHG emissions, followed by the agriculture sector (10.2 per cent), the industrial processes sector (7.0 per cent), the waste sector (2.8 per cent), and the solvent and other product use sector (0.2 per cent). Total GHG emissions amounted to 3,630,657.34 Gg CO_2 eq and decreased by 15.0 per cent between the base year[2] and 2011. The ERT concludes that the description in the national inventory report (NIR) of the trends for the different gases and sectors is reasonable.

4. Tables 1 and 2 show GHG emissions from sources included in Annex A to the Kyoto Protocol (hereinafter referred to as Annex A sources), emissions and removals from the LULUCF sector under the Convention and emissions and removals from activities under Article 3, paragraph 3, and, if any, elected activities under Article 3, paragraph 4, of the Kyoto Protocol (KP-LULUCF), by gas and by sector and activity, respectively. In table 1, CO_2, CH_4 and N_2O emissions included in the rows under Annex A sources do not include emissions and removals from the LULUCF sector, and also do not include the emissions from deforestation that were included in the European Union's initial report

[1] In this report, the term "total GHG emissions" refers to the aggregated national GHG emissions expressed in terms of CO_2 eq excluding LULUCF, unless otherwise specified.

[2] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O for all member States concerned, and for HFCs, PFCs and SF_6 the base year is 1995 for Belgium, Denmark, Finland, Germany, Greece, Ireland, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom of Great Britain and Northern Ireland and 1990 for Austria, France and Italy. The base-year emissions include emissions from Annex A sources only.

under the Kyoto Protocol for the base year and subsequently used for the calculation of the assigned amount.

5. Additional background data on recalculations by the European Union in the 2013 annual submission, as well as information to be included in the compilation and accounting database, can be found in annex I to this report.

Table 1

Greenhouse gas emissions from Annex A sources and emissions/removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, by gas, base year [a] to 2011

			Gg CO_2 eq							*Change (%)*
		Greenhouse gas	*Base year[a]*	*1990*	*1995*	*2000*	*2008*	*2009*	*2010*	*2011*	*Base year–2011*
Annex A sources		CO_2	3 367 101.26	3 367 101.26	3 297 510.12	3 372 961.14	3 331 500.97	3 067 034.75	3 155 308.45	3 002 815.36	–10.8
		CH_4	435 572.18	435 572.18	406 652.53	366 014.55	301 796.69	296 084.94	293 458.50	287 160.16	–34.1
		N_2O	395 851.58	395 851.58	375 431.62	335 655.83	282 705.02	272 200.61	262 770.37	260 402.80	–34.2
		HFCs	41 378.18	27 881.79	39 992.13	44 952.05	62 767.54	66 040.25	69 310.92	70 745.54	71.0
		PFCs	15 680.51	17 329.44	11 717.52	8 093.38	4 119.62	2 715.01	3 192.58	3 460.73	–77.9
		SF_6	13 860.77	10 767.65	15 012.20	9 866.93	6 420.77	6 081.31	6 183.84	6 072.75	–56.2
KP-LULUCF	Article 3.3[b]	CO_2					–10 799.35	–15 354.22	–19 544.93	–19 166.46	
		CH_4					234.87	298.62	312.93	274.38	
		N_2O					290.90	721.82	945.46	682.05	
	Article 3.4[c]	CO_2	11 305.80				–232 145.88	–229 017.68	–205 460.47	–216 206.88	NA
		CH_4	6.91				655.60	769.91	899.54	743.54	NA
		N_2O	506.47				441.61	545.62	692.31	613.41	NA

Abbreviations: Annex A sources = sources included in Annex A to the Kyoto Protocol, KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NA = not applicable.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O for all member States concerned, and for HFCs, PFCs and SF_6 the base year is 1995 for Belgium, Denmark, Finland, Germany, Greece, Ireland, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom of Great Britain and Northern Ireland and 1990 for Austria, France and Italy.

[b] The "base year" for cropland management, grazing land management and revegetation under Article 3, paragraph 4, of the Kyoto Protocol is 1990. For activities under Article 3, paragraph 3, of the Kyoto Protocol and forest management under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

[c] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation.

[d] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation.

Table 2

Greenhouse gas emissions by sector and activity, base year[a] to 2011

		Gg CO_2 eq								*Change (%)*
	Sector	*Base year[a]*	*1990*	*1995*	*2000*	*2008*	*2009*	*2010*	*2011*	*Base year–2011*
Annex A	Energy	3 282 202.02	3 282 202.02	3 206 152.64	3 259 170.33	3 199 674.54	2 971 834.39	3 047 527.33	2 897 728.53	–11.7
	Industrial processes	368 142.60	353 202.01	350 330.54	309 929.00	292 495.73	254 056.34	260 580.93	253 234.19	–31.2
	Solvent and other product use	13 212.24	13 212.24	11 748.89	11 254.13	8 790.17	8 098.02	8 205.36	7 968.59	–39.7
	Agriculture	433 868.14	433 868.14	412 156.08	413 446.41	379 023.31	370 386.76	369 490.81	369 784.65	–14.8
	Waste	172 019.47	172 019.47	165 927.97	143 744.02	109 326.85	105 781.36	104 420.23	101 941.38	–40.7
	LULUCF	NA	–136 801.79	–162 623.48	–177 405.37	–182 978.14	–185 700.39	–169 846.73	–173 992.46	NA
	Total (with LULUCF)	**NA**	**4 117 702.09**	**3 983 692.64**	**3 960 138.51**	**3 806 332.47**	**3 524 456.48**	**3 620 377.92**	**3 456 664.88**	**NA**
	Total (without LULUCF)	**4 269 444.47**	**4 254 503.89**	**4 146 316.12**	**4 137 543.88**	**3 989 310.60**	**3 710 156.87**	**3 790 224.66**	**3 630 657.34**	**–15.0**
	Other[b]	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA, NO	NA
KP-LULUCF	Article 3.3[c] Afforestation and reforestation					–41 731.27	–44 780.97	–46 121.35	–45 666.79	
	Article 3.3[c] Deforestation					31 457.68	30 447.20	27 834.81	27 456.75	
	Total (3.3)					**–10 273.59**	**–14 333.77**	**–18 286.54**	**–18 210.03**	
	Article 3.4[d] Forest management					–233 029.29	–228 901.50	–205 081.67	–215 247.36	
	Article 3.4[d] Cropland management	9 600.26				1 981.30	1 330.31	1 480.18	827.46	–91.4
	Article 3.4[d] Grazing land management	2 218.92				–0.67	–130.96	–267.13	–430.03	–119.4
	Article 3.4[d] Revegetation	NA				NA	NA	NA	NA	NA
	Total (3.4)	**11 819.18**				**–231 048.66**	**–227 702.15**	**–203 868.62**	**–214 849.92**	**–1 917.8**

Abbreviations: Annex A sources = sources included in Annex A to the Kyoto Protocol, KP-LULUCF = LULUCF emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, LULUCF = land use, land-use change and forestry, NA = not applicable, NO = not occurring.

[a] "Base year" for Annex A sources refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O for all member States concerned, and for HFCs, PFCs and SF_6 the base year is 1995 for Belgium, Denmark, Finland, Germany, Greece, Ireland, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom of Great Britain and Northern Ireland and 1990 for Austria, France and Italy. The "base year" for cropland management, grazing land management and revegetation under Article 3, paragraph 4, of the Kyoto Protocol is 1990. For activities under Article 3, paragraph 3, of the Kyoto Protocol and forest management under Article 3, paragraph 4, only the inventory years of the commitment period must be reported.

[b] Emissions/removals reported in the sector other (sector 7) are not included in Annex A to the Kyoto Protocol and are therefore not included in Party totals.

[c] Activities under Article 3, paragraph 3, of the Kyoto Protocol, namely afforestation and reforestation, and deforestation.

[d] Elected activities under Article 3, paragraph 4, of the Kyoto Protocol, including forest management, cropland management, grazing land management and revegetation.

II. Technical assessment of the annual submission

A. Overview

1. Annual submission and other sources of information

6. The 2013 annual inventory submission was submitted on 15 April 2013 and revised estimates were submitted on 27 May 2013; it contains a complete set of common reporting format (CRF) tables for the period 1990–2011 and an NIR. The European Union also submitted the information required under Article 7, paragraph 1, of the Kyoto Protocol, including information on: activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, accounting of Kyoto Protocol units, changes in the national system and in the national registry, and the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol. The standard electronic format (SEF) tables were submitted on 15 April 2013 and revised tables were submitted on 27 May 2013. The annual submission was submitted in accordance with decision 15/CMP.1.

7. The European Union officially submitted revised emission estimates for reporting under the Kyoto Protocol (revised emission estimates were not submitted for reporting under the Convention) on 18 November 2013 in response to the list of potential problems and further questions raised by the ERT. The values used in this report are those submitted by the European Union on 18 November 2013.

8. The full list of materials used during the review is provided in annex II to this report.

2. Overall assessment of the inventory

9. Table 3 contains the ERT's overall assessment of the annual submission of the European Union. For recommendations for improvements related to cross-cutting issues for specific categories, please see the paragraphs cross-referenced in the table.

Table 3
The expert review team's overall assessment of the annual submission

		General findings and recommendations
The expert review team's (ERT's) findings on completeness of the 2013 annual submission		The GHG inventory of the European Union is the summation of the annual submissions of the 15 individual member States. In cases where a member State reports not estimated ("NE") for a mandatory category, the ERT recommends that the Party strengthen its system to check whether the category is really not estimated (as opposed to not occurring, "NO") and if the activity occurs, report emissions for that member State to ensure complete reporting. The ERT encourages the Party to improve the completeness of reporting of emissions from non-mandatory categories
Annex A sources[a]	Not complete	Mandatory: For the EU–15, "NE" is reported for: CH_4 emissions from enteric fermentation and manure management – buffalo and mules and assess (Netherlands); and CH_4 emissions from domestic and commercial wastewater – sludge (Belgium)
		The ERT noted that during the 2013 annual review process for individual member States' 2013 annual submissions, many of the "NE's" were resolved. Other NE's mentioned above were

		General findings and recommendations
		determined to possibly be due to use of an incorrect notation key. Therefore the ERT recommends that in future, the Party review these notation keys and either revise the notation key or ensure emissions are estimated to ensure complete European Union reporting.
		Non-mandatory: Individual member States in the EU–15 reported "NE" for several non-mandatory categories in all sectors, while the European Union presented the sum of the member States that did report an estimate. This means that the total presented, is less than what the European Union total for the sector would be if all member States reported the same non-mandatory categories.
Land use, land-use change and forestry[a]	Not complete	Mandatory: Several categories and pools are reported as "NE" by individual member States. See also paras. 76 and 81–83 below
		Non-mandatory: Several categories and pools are reported as "NE" by individual member States
KP-LULUCF	Not complete	See paragraphs 95 and 96 below
The ERT's findings on recalculations and time-series consistency in the 2013 annual submission	Generally consistent	For category-specific findings and recommendations see paragraphs 35, 57, 59, 60, 68, 79 and 85 below
The ERT's findings on verification and quality assurance/quality control procedures in the 2013 annual submission	Not sufficient	The ERT noted internal inconsistencies in the NIR and between the NIR and CRF tables, as well as minor drafting issues (e.g. inconsistent use of country codes). The Party explained that the NIR was produced by revising the NIR from the previous annual submission, based on the member States' own new NIRs, in a very short period of time which does not allow for external review. The ERT believes that given their widespread nature and impact on the transparency of the NIR, these inconsistencies do indicate that the QA/QC of the NIR is insufficient. The ERT is concerned that these problems appear to be accumulating, leading to a potential lack of transparency. The ERT strongly reiterates the recommendation that the European Union improve the QA/QC of the NIR, considering both internal consistency and consistency with the CRF tables. Additional findings and category-specific recommendations are discussed in paragraphs 13, 14, 21, 23, 32, 46 and 77 below
The ERT's findings on the transparency of the 2013 annual submission	Generally sufficient	Although the annual submission of the European Union is generally transparent, category-specific issues were identified in all sectors (see paras. 28, 31, 33, 44, 45, 66, 77, 79, 82, 84, 90, and 97)

Abbreviations: Annex A sources = sources included in Annex A to the Kyoto Protocol, KP-LULUCF = land use, land use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NE = not estimated, NO = not occurring, QA/QC = quality assurance/quality control.

[a] The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, or the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*).

3. Description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

Inventory planning

10. The NIR and additional information provided by the Party in response to questions raised by the ERT during the review described the national system for the preparation of the inventory. The Directorate-General for Climate Action (DG CLIMA) of the European Commission has overall responsibility for the inventory. The European Environment Agency (EEA) and its European Topic Centre on Air Pollution and Climate Change Mitigation (ETC/ACM) conduct initial checks of member States' annual submissions and prepare the final European Union inventory and NIR. Eurostat compiles the reference approach under the energy sector, while the Joint Research Centre (JRC) is responsible for the improvement of methodologies for the agriculture and LULUCF sectors. Each member State is responsible for the preparation of its own inventory, which is the basic input to the inventory of the European Union.

11. The legal basis for the compilation of the Party's inventory is decision 280/2004/EC concerning a mechanism for monitoring European Community GHG emissions and for implementing the Kyoto Protocol. In 2013, decision 280/2004/EC was replaced by Regulation 525/2013 on a mechanism for monitoring and reporting GHG emissions and for reporting other information at the national and European Union levels relevant to climate change. Under decision 280/2004/EC, the member States submit their GHG inventories to the European Commission by 15 January of each year. EEA and its ETC/ACM, Eurostat and JRC perform initial checks on the submitted data and the draft European Union GHG inventory and NIR are circulated to the member States for review. If necessary, member States send updates and review the European Union's NIR by 15 March, and EEA and its ETC/ACM then prepare the final European Union GHG inventory and NIR for submission on 15 April.

12. The ETC/ACM was established by a contract between the National Institute for Public Health and the Environment (RIVM) in the Netherlands and EEA for the years 2011–2013. Recommendations made in the previous review report included that the Party report on how it plans to sustain the inventory preparation activities in the years after 2013. The EU reported in its 2013 NIR that procurement was underway for 2014–2018. In response to questions raised by the ERT during the review, the ERT was informed that a framework partnership agreement (reference No. EEA/ACC/13/001) concerning ETC/ACM was signed by EEA and RIVM Netherlands in August 2013. The EEA finalized the first Implementation Plan for 2014 at a meeting of the EEA Management Board on 27 November 2013. It is planned that ETC/ACM partner organizations (Umweltbundesamt Austria, Oeko Institute Germany and Emisia Greece) will continue to assist the European Union in preparing the annual submission and thus continuity will be ensured between the old and new contract periods, however contracts were not in place at the time of the review. The ERT recommends that the European Union ensure that all contracts and agreements are in place and that continuity is assured.

13. Throughout the review, the European Union emphasised to the ERT that the European Union inventory was different from the inventories of other Parties because it is compiled from member States' inventories. The ERT agreed that there are specific factors related to the European Union inventory that impact the way it is compiled. For example,

the total European Union emissions and removals must match the sum of the emissions and removals of the member States to ensure consistency of reporting under the Kyoto Protocol. The ERT agrees that the most accurate European Union estimates should be achieved by summing member States emissions, if the member States' inventories are accurate. In addition, this will ensure that the European Union is comparable with other Parties' emission and removal estimates. Thus, the ERT agrees that the requirements of accuracy, consistency, comparability and completeness set out in the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) are best achieved by summing the member States' emissions rather that making new estimates. This approach does have implications for quality assurance/quality control (QA/QC), as well as the key category and uncertainty analyses (see paras. 14, 19, 21 and table 4 below).

14. The member States of the European Union are an integral part of the European Union's GHG inventory preparation. The responsibility for the choice of methods, emission factors and other parameters, the data collection (particularly activity data (AD) from statistical services and other entities), and the processing and archiving of these data lie with the member States. The member States are also responsible for the quality of AD, emission factors (EFs) and other parameters used in their inventories as well as for adherence to the IPCC methodologies and for establishing national QA/QC plans for their inventories as part of their national inventory systems. Under EU legislation, the European Commission's role is limited to assisting the member States in implementing their own national QA/QC programmes. The European Commission is responsible for the QA/QC activities at the EU level at several different stages during the preparation of the inventory. In its QA/QC plan, the European Commission aims to ensure that the member States' estimates are consistent and complete so that they can be compiled in a transparent way and that the European Union CRF tables and the NIR are correctly compiled from the member States' submissions. The only changes allowed by the European Commission under this system are gap filling (e.g. the European Commission can provide an estimate where a member State reports the notation key not estimated ("NE") for a mandatory category) but the European Union had determined that this was not needed in the 2013 annual submission. The European Union has established a web-based tool for communicating with member States on potential issues, which the ERT believes provides an efficient communication mechanism as well as an effective means of tracking and archiving the communications and their outcomes.

15. The draft European Union inventory and draft NIR are sent to each member State for consideration and comments before final approval by the European Commission and submission to the UNFCCC.

16. The system in the European Union has two areas which require careful management: timeliness is key because the time between submission of member States' inventories and the official submission of the European Union is short (three months); and the correction of errors identified in compiling the European Union inventory requires close cooperation between the European Union and its member States. The legal basis for the cooperation between member States and the EU Commission is laid down in Regulation No 525/2013 and generally appears to work well. The ERT notes that this may require special attention in the 2014 annual submission. The ERT recommends that the Party continue its efforts to ensure that any errors identified during the compilation of the European Union inventory from the inventories of the member States be addressed in a timely manner.

Inventory preparation

17. Table 4 contains the ERT's assessment of the European Union's inventory preparation process. For improvements related to specific categories, please see the paragraphs cross-referenced in the table.

Table 4
Assessment of inventory preparation by the European Union

		General findings and recommendations
Key category analysis		
Was the key category analysis performed in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF)?	Yes	The ERT welcomes the inclusion of a key category analysis with and without LULUCF. However this is done at the most disaggregated level of European Union total emissions (i.e. the sum of the member States' emissions for the most disaggregated level of each subcategory) without any aggregation as recommended in the IPCC good practice guidance (section 7.2, page 7.5). Although this results in a large list of key categories which does not match the key categories in the member States, the ERT finds that the European Union uses this analysis to guide QA/QC efforts, to identify areas for extended discussion in the NIR and to guide prioritization of topics in the improvement plan. The ERT concludes that the Party has adopted an appropriate Party-specific approach to the key category analysis
Approach followed?	Both tier 1 and tier 2	
Were additional key categories identified using a qualitative approach?	No	
Has the Party identified key categories for activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol following the guidance on establishing the relationship between the activities under the Kyoto Protocol and the associated key categories in the UNFCCC inventory?	Yes	
Does the Party use the key category analysis to prioritize inventory improvements?	Yes	
Are there any changes to the key category analysis in the latest submission?	Yes	The European Union now provides a tier 1 and tier 2 key category analysis with and without LULUCF CO_2 emissions from civil aviation and ammonia production were identified as a key

		General findings and recommendations
		category in the 2012, but not the 2013, annual submission; CO_2 emissions from lime production and CO_2 emissions from other land have become key in the 2013 annual submission
Assessment of uncertainty analysis		
Approach followed?	Both tier 1 and tier 2	
Was the uncertainty analysis carried out in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF?	Yes	For tier 1, the European Union does not follow the IPCC good practice guidance (section 6.3.3, page 6.18) on using aggregation to deal with correlations in the simple tier 1 approach. Although this was discussed with the Party during the review, it remains unclear to the ERT why the European Union does not follow the IPCC good practice guidance on this matter as the IPCC tier 1 approach, if followed, provides consistency between Parties at the expense of precision. The ERT encourages the Party either to provide a justification for not using the IPCC approach on dealing with correlations or to adopt the IPCC approach to ensure consistency with other Parties' estimates
Quantitative uncertainty (including LULUCF)	Level = 8.3% Trend = 1.4%	
Quantitative uncertainty (excluding LULUCF)	Level = 7.9% Trend = 1.1%	

Abbreviations: ERT = expert review team, LULUCF = Land use, land-use change and forestry, QA/QC = quality assurance/quality control.

18. DG CLIMA is responsible for coordinating QA/QC activities for the Party's inventory and ensures that the objectives of the QA/QC programme are implemented and that the QA/QC plan is developed. EEA is responsible for the annual implementation of QA/QC procedures. QC procedures are performed at three stages of the inventory preparation process. Firstly, a range of checks are used to determine the consistency and completeness of member States' data so that they may be compiled in a transparent manner at the European Union level. Secondly, checks are carried out to ensure that the data are compiled correctly at the European Union level to meet the overall reporting requirements. Thirdly, a number of checks are conducted with regard to data archiving and documentation to meet various other data quality objectives.

19. Where issues are raised by these QC checks, a web-based system is used to ask member States to explain the issue. The system also archives the issues and responses. Members States are expected to explain the reasons for the issues and if a problem is identified to correct it and recalculate their inventory and submit revised estimates to the European Union for incorporation in the European Union inventory. The ERT noted that,

with the exception of gap filling, which was not needed in the 2013 annual submission, in this system the responsibility for correcting inventories lies with the member States who can choose not to recalculate their inventory. Issues raised by the ERT during the review are also fed back to member States for them to address either during the review process or in a subsequent annual submission.

20. The European Union produces an annual improvement plan based on issues identified and unresolved during the compilation of the European Union inventory and any issues raised in the annual review reports. Actions may include: improvements to be undertaken by the European Union in their inventory compilation process; initiating workshops to address specific issues; undertaking discussion in a working group; or referring specific issues to individual member States to be addressed by that member State.

21. In response to questions raised by the ERT during the review on QA activities, the Party confirmed that the primary QA checks conducted on the GHG inventory were carrying out the reference approach for the energy sector as well as sector- or category-specific checks (e.g. comparing GHG inventory data with data from the European Union emissions trading system (EU ETS) in the energy sector or comparing fluorinated gas (F-gas) emissions aggregated from the member States with data derived from the F-gas model of the European Commission). The ERT noted that personnel external to the inventory were not used in QA checks before submission of the inventory. In addition, the ERT concludes that additional QA checks performed earlier in the compilation process (e.g. using European Union-level data collected from statistical bodies across the European Union such as Eurostat, international organizations and industry bodies to enable the development of implied emission factors (IEFs)) would further enhance the quality of the Party's GHG inventory. The ERT encourages the European Union to establish a process for external QA of its inventory before submission.

22. The ERT noted that the European Union has provided many tables in the NIR giving details on tiers and sources of EFs used in the member States' estimates for each subcategory (e.g. table 3.6). The ERT believes such tables are very useful. However, the information is often reported in an inconsistent way. For example table 3.51 (road transport, gasoline) does not describe all methods as tier 1, 2 or 3 (e.g. Belgium reports "other (OTH)", Austria reports "country specific, model"). Further, these labels are not always consistent with the accompanying text in the NIR. The ERT also noted that not all abbreviations are explained (e.g. OTH, CR) and the version of the core inventory of air emissions (CORINAIR) used is not specified. The ERT recommends that the European Union check these tables and ensure that: all member States' methods are correctly and consistently classified where tiers are provided in the Revised 1996 IPCC Guidelines or the IPCC good practice guidance; all codes used in the table are explained in the section *Units and abbreviations*; and references to sources such as CORINAIR are included.

23. Many background CRF tables do not contain any AD, and thus no IEFs (e.g. CRF tables 1.B.2, 2(I).A–G, 2(II).C, 3.A–D, 5(V) and 6.B). The Party explained this was because the member States estimated emissions in different ways using and reporting differing types of AD (e.g. lime production and limestone use). Thus, simply summing the AD would not be correct and the Party was reluctant to introduce AD that were not used by the member States. The ERT noted that not all the AD actually reported by the European Union were the data used in the emission estimation (e.g. in the energy sector some emission data come from the EU ETS and some are estimated from fuel consumption while the reported AD is the sectoral total fuel consumption). In order to facilitate comparisons with other Parties and as part of QA, the ERT recommends that the European Union improve the reporting of AD by using data representing the Party as a whole and, together with total European Union emissions, estimate the Party's IEFs as described in paragraph 47(b) and the associated footnote 13 of the "Guidelines for the preparation of national

communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the UNFCCC reporting guidelines).

24. The ERT notes that the NIR is not consistent with the UNFCCC reporting guidelines that "[t]he national inventory report shall be submitted in one of the official languages of the United Nations" (para 53). The ERT recommends that a future NIR of the European Union use a single official United Nations language.

Inventory management

25. The European Union has an archiving system, which includes the archiving of disaggregated EFs and AD, and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. The archived information also includes internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key categories and key category identification and planned inventory improvements. An archive, hosted by Umweltbundesamt Austria (Environment Agency Austria), holds all the information used by the Party in compiling its inventory from the member States' submissions together with the associated QA/QC documents, plans and communications with member States, while the detailed EFs, parameters and other information on the detailed calculation methods are stored separately for each member State in its national archives. The European Union does not have a centralized archiving system. During the review, the ERT was provided with the requested additional archived information.

4. Follow-up to previous reviews

26. The ERT welcomes the improvements made by the European Union in the 2013 annual submission in response to recommendations made in the previous review report, including:

(a) Providing information in the NIR related to the difference in the member States' national territorial areas for the Convention and Kyoto Protocol reporting (particularly Denmark and the United Kingdom);

(b) Presenting the information in CRF table 9(a) in a more summary fashion;

(c) Providing a full uncertainty analysis using tiers 1 and 2 in its 2013 annual submission. Recommendations made in the previous review report included that the European Union provide a short discussion of the cause of the increase in uncertainty. However in this annual submission, with a complete tier 2 method used, the uncertainty in 1990 was 5.1 per cent and in 2011, 4.9 per cent. The ERT believes this addresses the issue.

27. The ERT commends the European Union for its efforts to encourage all of its member States to improve the completeness of their inventories, particularly for the LULUCF sector and KP-LULUCF activities. However, the ERT notes that there are still a number of gaps, especially in the reporting of KP-LULUCF activities, so the ERT reiterates the recommendation made in the previous review report that the European Union encourage all of its member States to improve the completeness of their inventories, particularly for the LULUCF sector and KP-LULUCF activities.

28. The previous review report noted that the Party reports a number of country-specific subcategories under the category other. However, they are reported at an aggregated level as "non-specified", without providing a specific description of the subcategories included in the CRF tables (i.e other (manufacturing industries and construction), fugitive emissions from oil and natural gas, and agricultural soils – N_2O). The previous review report recommended that the European Union make efforts to summarize the country-specific

subcategories reported by the member States and report a list of the subcategories reported under the category other in the CRF tables, in order to improve the transparency of the reporting in its next annual submission. The EU has not done this. In response to the draft review report the EU indicated that the previous review report was published too late to allow the implementation of this recommendation (4 June 2013). The ERT reiterates the recommendation made in the previous review report that the European Union make efforts to summarize the country-specific subcategories reported by the member States and report a list of the subcategories reported under the category other in the CRF tables.

5. Areas for further improvement identified by the expert review team

29. During the review, the ERT identified a number of areas for improvement, including some related to specific categories. These are listed in the relevant chapters of this report and in table 8.

B. Energy

1. Sector overview

30. The energy sector is the main sector in the GHG inventory of the European Union. In 2011, emissions from the energy sector amounted to 2,897,728.53 Gg CO_2 eq, or 79.8 per cent of total GHG emissions. Since 1990, emissions have decreased by 11.7 per cent. The key drivers for the fall in emissions are the reduction in emissions from manufacturing industries and construction (166,698.72 Gg CO_2 eq or 25.9 per cent), largely due to reductions in Germany after the reunification, and energy industries (125,628.55 Gg CO_2 eq or 10.8 per cent), in particular due to reductions in CO_2 emissions from public electricity and heat production. Within the sector, 35.9 per cent of the emissions were from energy industries, followed by 27.5 per cent from transport, 18.4 per cent from other sectors and 16.4 per cent from manufacturing industries and construction. Fugitive emissions from oil and natural gas accounted for 1.3 per cent and fugitive emissions from solid fuels accounted for 0.3 per cent. The remaining 0.2 per cent were from other (energy).

31. The emission estimates in the energy sector are the sum of the data reported in the CRF tables of the member States as submitted to the European Union by 15 April 2013. Although this ensures consistency between the member States and the European Union it does introduce some issues of transparency. One example is the use of biomass, where the United Kingdom and Sweden report the total municipal solid waste (MSW) used for energy purposes and apply an EF that accounts for the fossil carbon fraction of the fuel, while other members States report the fossil fraction of the fuel only. Thus, while the resultant emissions are correct, the AD and IEFs are inconsistent, reducing transparency. Furthermore, in some categories, member States use different methods and EFs for the same categories (e.g. see para. 40 below), however the ERT does not believe these give rise to significant inconsistencies in the reported emissions and also agrees that the results comply with IPCC good practice guidance. The ERT acknowledges the efforts the European Union has made to address these issues and to improve transparency and consistency of reporting across the member States, but recommends that the Party continue its efforts and processes to ensure consistent reporting.

32. The previous review report noted an issue in the NIR regarding the documentation of the member States' information. For example, in the 2012 annual submission, in the table explaining the methods/models used for estimating emissions from road transportation, the NIR states that Sweden uses ARTEMIS, but Sweden actually began to use HBEFA 3.1 in 2012. This was corrected in the 2013 annual submission but the ERT noted that the 2013 NIR states that "[a]t the moment two versions of the COPERT model are being used in EU–15 countries to estimate emissions, namely COPERT III and

COPERT 4" (page 220), while table 3.56 indicates that only COPERT 4 is used." In response to an earlier draft of this report, the European Union revealed that, in fact, COPERT III was used by only one region of Belgium. The ERT reiterates the recommendation made in the previous review report that the European Union strengthen the QA/QC procedures to ensure that the member States' information is updated and correctly represented in the NIR.

33. The NIR is generally transparent, however, as also noted in the previous review report, while explaining the trend in the emissions per category the Party indicates the member States with the main responsibility for the observed trend, but does not always provide information on the reasons for the trend in the emissions and the IEFs. The ERT reiterates the recommendation made in the previous review report that the European Union further encourage the consistency of reporting of fuels across member States and, where relevant (e.g. where there are deviations of the IEFs due to the misallocation of a fuel by different member States), include a table summarizing the allocation of fuels across subcategories and sectors among member States (e.g. allocation across the energy and industrial processes sectors, and allocation of biomass across member States), in order to improve the transparency of the reporting.

2. Reference and sectoral approaches

34. Table 5 provides a review of the information reported under the reference approach and the sectoral approach, as well as comparisons with other sources of international data. Issues identified in table 5 are more fully elaborated in paragraphs 35–37 below.

Table 5
Review of reference and sectoral approaches

		Paragraph cross-references
Difference between the reference approach and the sectoral approach.	Energy consumption: 66.67 PJ, 0.17 % CO_2 emissions: 7,946.50 Gg CO_2 eq, 0.28 %	
Are differences between the reference approach and the sector approach adequately explained in the NIR and the CRF tables?	Yes	
Are differences with international statistics adequately explained?	Yes	
Is reporting of bunker fuels in accordance with the UNFCCC reporting guidelines?	Yes	36
Is reporting of feedstocks and non-energy use of fuels in accordance with the UNFCCC reporting guidelines?	Yes	37

Abbreviations: CRF = common reporting format, NIR = national inventory report, UNFCCC reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories".

Comparison of the reference approach with the sectoral approach and international statistics

35. Unlike the rest of the inventory, the reference approach is not a compilation of member States' submissions but is compiled using energy balance data from Eurostat. The reference approach was also performed for each member State and, as might be expected, this gave rise to larger differences (of the order of one percent), but no problems were identified. Following a recommendation made in the previous review report, the Party uses a weighted average of the carbon stored fractions of the member States to estimate carbon stored, in order to potentially reduce the differences in the estimated apparent fuel consumption between the reference and the sectoral approaches. However, as was noted in the previous review report, the weighted average value was used only for the fuels for which the IPCC default values are far from the weighted averages of the member States (i.e. for natural gas and lubricants) and only for 2009 onwards. The ERT reiterates the recommendation made in the previous review report that the European Union explain why the weighted average of the carbon stored fractions of the member States is not used for all fuels, and also recommends that the Party use a consistent methodology for the entire time series or further justify its current approach.

International bunker fuels

36. Consistent with the UNFCCC reporting guidelines and Revised 1996 IPCC Guidelines, the EU regards international travel as being between countries, thus trips between member States, but internal to the EU, are regarded as international. The previous annual review report noted that the consumption of jet kerosene for civil aviation reported to the International Energy Agency (IEA) did not match the value reported in the CRF tables (for 2010, data reported to the IEA was 16.6 per cent higher than that reported in the CRF tables). The Party had noted that this could be the result of a different split between domestic and international aviation. The European Union also indicated that there is ongoing work in collaboration with Eurocontrol (the European organization for the safety of air navigation), which aims to improve the accuracy of the estimates across member States. The previous review report noted that the results of this were intended to be reported in the 2013 annual submission. Progress has been made with preliminary results presented to member States. However, issues were identified around the use of International Air Transport Association (IATA) data on taxiing times, and these will need to be addressed before the new data can be used. The ERT commends the European Union on progress so far and encourages the Party to facilitate further improvements and to encourage member States to use the results from this work in order to improve the allocation of fuel between domestic and international uses.

Feedstocks and non-energy use of fuels

37. The allocation of emissions between the energy and the industrial processes sectors is not entirely consistent between all member States. For example for iron and steel production (see para. 39 below) some members States report all fossil fuel use in the energy sector while some allocate fuel used as a reducing agent to the industrial processes sector. These differences reflect the availability of the underlying data and the ERT concludes that the approach does allow all emissions to be estimated. The ERT recognizes the efforts of the European Union to standardize reporting in the member States and encourages it to continue with this work.

3. Key categories

Stationary combustion: all fuels – CO_2, CH_4, and N_2O[3]

38. The member States base their emissions estimates on a mixture of fuel consumption data and data from the EU ETS. The EU ETS data may be measured emissions (especially for the largest plants), or based on plant-specific fuel consumption and an EF. EU ETS data are collected from the large plants only, thus categories where there are a large number of small combustion plants are not well covered and so energy statistics are used to ensure completeness. The EU ETS data can be used for emissions data directly or as a QA/QC check of estimated data. Member States decide the most appropriate approach to using EU ETS data for their circumstances. Thus the approach used is not consistent throughout the European Union, however the Party indicated that comparisons with energy data and the reviews performed in compiling the inventory demonstrate that the estimates are complete and consistent. The ERT did not identify any issues with this approach; however, the ERT encourages the European Union to continue to encourage consistency in the application of EU ETS data by its member States.

39. The methodology for splitting emissions from blast furnaces into energy-related emissions (reported under manufacturing industries and construction) and process-related emissions (reported under metal production in the industrial processes sector) does not follow a standard approach for all member States (e.g. in 2011, Germany reports 68 per cent of total CO_2 emissions from iron and steel under manufacturing industries and construction while Italy reports 93 per cent of emissions). Although this does introduce some inconsistency and lack of transparency into the reporting, the ERT believes this does represent an accurate approach given the diversity of data available at the member State level.

Road transportation: all fuels – CO_2, CH_4, N_2O[4]

40. Member States use different models (either COPERT IV or HBEFA, or derivatives of them) to estimate emissions from road transport. In principle, this could lead to inconsistencies between member States, as similar vehicles would be treated differently depending on the country in which they were being used. However, the CO_2 emission estimates are, in both models, based on fuel consumption and the carbon content of the fuel, while for CH_4 and N_2O, both models are based on the same underlying emission measurements and give similar results. Thus the ERT does not think the use of these different models gives rise to any significant inconsistency.

Oil and natural gas: natural gas – CH_4

41. The European Union has reported emissions of 54.14 Gg CH_4 in CRF table 1.B.2 for the subcategory other leakage (natural gas). For this subcategory, Spain reports "NE". The ERT notes that a default IPCC method and an EF are available for estimating these CH_4 emissions. The ERT further notes that this has been raised in recommendations made in previous review reports of other member States, in particular for the United Kingdom of Great Britain and Northern Ireland (which was subject to an adjustment) and Lithuania (which submitted revised estimates in response to the list of potential problems and further

[3] Not all emissions related to all gases under this category are key categories, particularly CO_2 from biomass, and CH_4 and N_2O emissions. However, since the calculation procedures for issues related to this category are discussed as whole, the individual gases are not assessed in separate sections.

[4] Not all emissions related to all gases under this category are key categories, particularly only CO_2, CH_4 and N_2O emissions from liquid fuels are key. However, since the calculation procedures for issues related to this category are discussed as whole, the individual gases are not assessed in separate sections.

questions raised by the ERT during the review of the 2010 annual submission of Lithuania). In response to a question raised by the ERT during the review, the EU indicated that Spain said that because a default EF was not provided in the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) or in the IPCC good practice guidance, Spain was not required to report CH_4 emissions from this subcategory. The ERT noted that although specific EFs for Western Europe are not provided in the Revised 1996 IPCC Guidelines, in table 1.58, data are given for the "rest of the world" which the ERT believed should be the basis for a default estimate. The ERT also noted that these emissions are reported using the notation key "IE" (included elsewhere) by many Parties and that it is not entirely clear whether or not they are included elsewhere in Spain as well. The ERT considered that this was a potential underestimation of emissions and included this in the list of potential problems and further questions raised by the ERT during the review.

42. In response to the list of potential problems and further questions raised by the ERT during the review, the European Union reiterated that Spain did not estimate CH_4 emissions from this subcategory as a method does not exist in the Revised 1996 IPCC Guidelines or the IPCC good practice guidance; that there is a lack of a precise definition of the subcategory 'other leakage'; and that considering "legislation in Spain, no emissions from 'other leakage' seem to occur in Spain and appropriate measures have been taken to prevent occurrence". The ERT notes that this subcategory clearly includes all fugitive emissions not included in the other subcategories under natural gas, including leakage at industrial plants and power stations and leakage in the residential and commercial sectors, and also notes that there is clearly a method in the Revised 1996 IPCC Guidelines for CH_4 emissions from leakage at industrial plants and power stations and in the residential and commercial sector. However, the ERT acknowledges that there is a lack of clarity regarding the specific EFs to be applied for Western Europe (i.e. whether emissions are already captured by the default EFs for transmission or distribution, or whether Western Europe should apply default EFs from other regions). The ERT does not believe that there are no emissions in this subcategory in Spain: other countries either report emissions or include these emissions elsewhere and zero leakage seems implausible. Therefore, in order to ensure completeness and to improve the consistency with other Parties' emission inventories (especially those for which specific EFs are available in the Revised 1996 IPCC Guidelines, or which have added these emissions in response to recommendations made in previous review reports), the ERT encourages the European Union to review the coverage of emissions from leakage at industrial plants and power stations, as well as leakage in the residential and commercial sectors and, as appropriate, either revise the notation key or include these emissions, considering, if necessary, EFs used elsewhere in Europe.

C. Industrial processes and solvent and other product use

1. Sector overview

43. In 2011, emissions from the industrial processes sector amounted to 253,234.19 Gg CO_2 eq, or 7.0 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 7,968.59 Gg CO_2 eq, or 0.2 per cent of total GHG emissions. Since 1990, emissions have decreased by 31.2 per cent in the industrial processes sector, and decreased by 39.7 per cent in the solvent and other product use sector. The key driver for the fall in emissions in the industrial processes sector is the reduction of N_2O emissions from chemical industry due to the closure of certain plants and the installation of N_2O abatement technologies in the production of adipic acid and nitric acid. Within the industrial processes sector, 35.7 per cent of the emissions were from mineral products, followed by 30.2 per cent from consumption of halocarbons and SF_6, 16.9 per cent from metal production and 15.9 per cent from chemical industry. Production of

halocarbons and SF_6 accounted for 1.0 per cent and other (industrial processes) accounted for 0.2 per cent. The remaining 0.04 per cent were from other production.

44. The Party has made improvements in the transparency of the NIR. The ERT commends the European Union in particular for providing a short description of the reason for the decrease in N_2O emissions from adipic acid production (by 85.3 per cent) between 2009 and 2010, owing mainly to a decrease in the emissions reported by Germany due to the retrofitting of installations with abatement technologies (p. 385 of the NIR) and for developing and implementing QA/QC procedures for the solvent and other product use sector, addressing a recommendation made in the previous review report. Nevertheless, issues related to transparency remain. For example, background data, such as AD, are generally not transparent in this sector due to confidentiality in the individual member States (e.g. clinker production in one member State, ammonia production in two member States, nitric acid production in two member States, adipic acid production in three member States and aluminium production in four member States) or, as noted by the European Union in response to questions raised by the ERT during the review, due to the inability to aggregate AD owing to the use of various types of AD (e.g. lime production and limestone consumption, ammonia production and natural gas consumption). Although the ERT concludes that these issues do not affect the accuracy of the emissions totals reported, they reduce transparency. The ERT recommends that the European Union explore ways to replace the use of notation keys with actual values in background data (e.g. aggregates of AD could ensure the confidentiality of data in individual member States in many cases or the European Union could use alternative sources of AD (see para. 46 below)) in order to improve the transparency of the reporting of the background data.

45. Many member States do not provide potential emission estimates, so reporting of potential emissions at the European Union level is not complete. In response to questions raised by the ERT during the review, the Party explained that the issue of reporting F-gases has been discussed with the member States. The conclusion was that the calculation of potential estimates should not be a priority given the fact that the calculation of potential emissions of F-gases will no longer be required in the annual submissions from 2015 onwards due to the deletion of this method from 2006 IPCC Guidelines. However, consistent with the UNFCCC reporting guidelines, Annex I Parties reporting actual emissions should also report potential emissions for the categories where the concept of potential emissions applies, for reasons of transparency and comparability. The ERT encourages the European Union to complete its reporting of potential emissions. Further, the ERT noted that Poland is reporting potential emissions as actual emissions for HFC-23, HFC-32, HFC-125, HFC-143a and HFC-152a from commercial refrigeration and thus decreasing the accuracy, consistency and transparency of the EU-27 totals for actual emissions. The ERT therefore encourages the European Union to work with Poland and any other concerned member States in order to encourage them to use higher-tier methods (i.e. estimate actual emissions in addition to potential emissions). The ERT notes that separate estimates of actual and potential emissions for F-gases is also a useful QA/QC tool and encourages the Party to compare actual emissions with potential emissions at the level of the European Union.

46. The European Union has implemented a QC system for the industrial processes sector. However, checks are mainly done at the member State level and additional data at the Party level (e.g. aggregates from the European Union statistical system) are rarely used to cross-check the accuracy of the estimates resulting from the sum of individual member States' data. Where member States' bottom-up/plant-specific data are used to estimate emissions it is good practice to compare the emission estimates to the estimates calculated using production or "top-down" data. Some possible actions that the ERT encourages the Party to consider in order to improve QA/QC are:

(a) Create additional tools to enhance the QA of the reported F-gas estimates (e.g. the Party could create tools that would compare specific parameters (e.g. leakage rates, lifetime EF, disposal EF) in estimation methods/models for all member States), and/or cross-check annual estimates with consumption per capita;

(b) Include peer reviews of the inventory estimates by external experts not involved in the compilation of the inventory;

(c) Ensure that errors identified by the Party during QC activities for its inventory, but which occur at the member State level, are addressed in the current inventory cycle, to the extent possible.

47. The ERT encourages the European Union to record the results of the checks mentioned in paragraph 46 above, investigating and documenting the reasons for any differences identified and include explanations for any discrepancies, at least for internal documentation.

48. Most member States use EU ETS data to improve and refine the estimation and reporting of CO_2 emissions from industrial processes (mineral products and metal production), which are then reflected in the Party's annual submission. The use of EU ETS data has improved the quality of the Party's inventory: it is more complete (e.g. additional emissions categories reported for which no data were previously available), more accurate (e.g. more country-specific EFs and higher-tier methods used), and the allocation of emissions has been improved (e.g. energy and industrial process emissions). In the near future EU ETS data will also be available for the chemical industry (carbon black and nitric acid production). The ERT welcomes the use of EU ETS data and encourages the Party to concentrate efforts on exploring additional data sources for cross-checking the category consumption of halocarbons and SF_6, which is progressively becoming more important in the European Union in terms of the absolute level of emissions.

2. Key categories

Limestone and dolomite use – CO_2

49. The IEF in Belgium fluctuates from 3.75 t/t in 1990 to 0.41 t/t in 2011 with limestone and dolomite indicated as AD for both years. In response to questions raised by the ERT during the review, the Party clarified that the AD reported by Belgium in 1990 do not include AD from Wallonia, which explains the high IEF in 1990. The ERT notes that the error does not affect the emission estimates but recommends that the European Union correct the incomplete AD or provide an explanation of the IEF trend in the NIR.

Ammonia production – CO_2

50. In one of the ammonia production plants in Flanders (Belgium) CO_2 is subtracted from the estimated emissions because it is assumed that these emissions are stored in lime which is afterwards sold. The ERT noted that this is not in accordance with the Revised 1996 IPCC Guidelines because when carbon is stored for a short time (for example, in urea and dry ice), this carbon should not be subtracted from the plant emissions. As the carbon stored in both urea and lime during their manufacture is released into the environment during their consumption or application, the ERT assumes that in both cases carbon is stored for a short time. Thus the ERT considered that the subtraction of the CO_2 emissions from ammonia production that are used to produce lime was a potential underestimation of emissions and this issue was included in the list of potential problems and further questions raised by the ERT.

51. In response to the list of potential problems and further questions raised by the ERT, the Party provided confidential information about the process and explained that the carbon is stored in a lime product that is only applied as soil conditioner, at which point the carbon

is emitted as CO_2, and these emissions are accounted for in the LULUCF sector in the category liming of agricultural soils. The Party also provided justification on the allocation of emissions in the inventory. The Party explained that, because there is no category for urea consumption or application, CO_2 emissions resulting from the consumption of urea should not be subtracted from the ammonia production process emissions while CO_2 emissions resulting from the consumption of lime are attributed in this case to a category and should be subtracted to avoid double counting. The ERT considers the potential underestimate to be resolved but strongly recommends that the Party ensure this is transparently reported in the NIR by providing a more detailed description of the amount of CO_2 recovered during the ammonia production process, its allocation in the inventory, and how the completeness of the reporting is ensured.

52. In the United Kingdom, CO_2 emissions from ammonia production are assumed to be stored in chemical feedstocks in one plant. The CO_2 IEF is decreasing from 1990 to 2011 both including (–25.9 per cent) and excluding this plant (–11.8 per cent). In response questions raised by the ERT during the review regarding the kind of chemical feedstocks produced, explanations for the IEF trend to ensure that there was not a potential underestimate in emissions and on the chemical feedstocks in which the CO_2 is assumed to be stored (polymers and synthetic fibres), the Party justified why the carbon is assumed to be stored long-term (these products store the carbon and where the products are degraded or oxidized (e.g. in waste incinerators) then these releases are accounted for elsewhere in the inventory), and demonstrated the reliability of the AD and emissions data used in the United Kingdom inventory estimates that led to the decreasing IEF trend. The ERT considers that the additional information resolved the issue and recommends that the Party provide these more detailed explanations in the NIR.

Other (chemical industry) – CO_2 and CH_4[5]

53. Under this category Spain reports CH_4 emissions, but CO_2 emissions are reported as not applicable ("NA") and no additional justification is provided in the NIR. In response to questions raised by the ERT during the review regarding the kind of activities included in this subcategory and the non-reporting of CO_2 emissions in Spain, the Party provided the list of activities accounted for in Spain (styrene and ethylene production) and justified the non-reporting of CO_2 emissions by reference to the lack of methodologies in the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The ERT considers that the additional information resolved the issue and recommends that the European Union include this explanation in the NIR.

54. The Netherlands applies an oxidation factor of 20 per cent for industrial gases and 5 per cent for carbon electrodes, but the NIR does not clearly provide the rationale behind these values. In response to questions raised by the ERT during the review, the Party provided the ERT with further information regarding how the oxidation factors are derived and explained the method and the data on which these estimates are based (a carbon balance using data from the producers). The ERT considers this clarification useful and recommends that the Party present this information in the NIR.

Production of halocarbons and SF_6 – HFCs

55. Italy reports AD for HFCF-22 production as confidential ("C") and HFC-23 emissions as "NA". In response to a question raised by the ERT during the review about HFC-23 by-product emissions, the Party explained that these chemicals were produced, but

[5] Not all emissions related to all gases under this category are key categories, particularly CH_4 emissions. However, since the calculation procedures for issues related to this category are discussed as whole, the individual gases are not assessed in separate sections.

that since 1996 HFC-23 emissions are zero due to the construction of a second unit of the thermal-oxidation system. In response to further questions raised by the ERT during the review regarding the plant technology and the QA/QC undertaken to support a value of 100 per cent destruction, the Party replied that a monitoring system is in place in the plant and that in order to verify lack of HFC-23 emissions a monitoring campaign was implemented, including the monitoring of diffuse emissions with a leak detection and repair system, demonstrating negligible HFC-23 emissions. The ERT is not aware of any abatement plant with a 100 per cent efficiency and concluded that it would need to see evidence of this to ensure that there is not an underestimate of emissions. This issue was included in the list of potential problems and further questions raised by the ERT.

56. In response to the list of potential problems and further questions raised by the ERT, the Party officially submitted revised emission estimates for HFC-23 based on the measurements provided directly by the plant. Emissions for 2011 increased by 0.12 Gg CO_2 eq. After assessing the revised estimates and the descriptive summary of the calculations provided by the European Union (tier 2 methodology), the ERT concluded that the revised estimates are in accordance with the Revised 1996 IPCC Guidelines and that the industrial processes sector inventory is complete. The ERT recommends that the Party ensure that Italy includes HFC-23 emissions from HCFC-22 production in its subsequent annual submissions.

57. The ERT observed a decrease (–39.3 per cent) of by-product emissions of HFC-23 from HCFC-22 production in Spain between 2010 and 2011, which was not explained in the NIR. In response to questions raised by the ERT during the review, the Party demonstrated that the reason for the decrease was the higher estimate of HFC-23 emissions in 2010, which were estimated using a conservative approach because measurements were not undertaken in 2010 due to technical problems. The ERT notes that according to the UNFCCC reporting guidelines, emission estimates should be accurate, and therefore not an over- or underestimate of emissions, as far as can be judged. Nevertheless, the ERT concluded that underestimation is not occurring in this activity, but recommends that the Party ensure the most accurate estimate possible is developed and time series consistency is ensured.

Consumption of halocarbons and SF_6 – HFCs

58. Denmark and Luxembourg report HFC emissions from fire extinguishers as not occurring ("NO"). In response to questions raised by the ERT during the review, the European Union explained that HFCs are not allowed in fire extinguishers and no separate permissions have been granted to use such gases in fire extinguishers in these member States. As all Parties report HFC emissions under this category, the ERT considers that additional documentation is needed to justify the use of the notation key "NO". Thus the ERT strongly recommends that the European Union document in the NIR the non-existence of HFC emissions from this subcategory in Denmark and Luxembourg (e.g. by listing the agents in use in fire extinguishers used in these countries).

59. HFC emissions from solvents are reported by two member States (France and the United Kingdom). The emissions reported are the same in 2010 and 2011 while the entire time series shows an increasing trend. In response to questions raised by the ERT during the review, the Party explained that in the concerned countries no data were available for 2011 and emissions were assumed to remain constant from 2010. The European Union also clarified that there is an increase of closed equipment which would generate a reduction of emissions not taken into account in the estimates. The Party confirmed that there is currently research underway to improve the estimates and obtain more detailed data on HFC emissions in both countries. The ERT welcomes the planned improvements and recommends that the Party either implement them or provide additional justification in the NIR as to why the current estimates are an accurate assessment of emissions.

3. Non-key categories

Other production – CO_2

60. For food and drink, there was a large inter-annual change in CO_2 emissions between 2010 (30.88 Gg CO_2 eq) and 2011 (21.08 Gg CO_2 eq). The 2011 value is 31.7 per cent lower than 2010. This change is due to reduction of emissions (by 10.30 Gg CO_2 eq) reported by the Netherlands. In response to a question raised by the ERT during the review, the European Union explained that the CO_2 emissions reported by the Netherlands in this category result only from the non-energy use of fuels in the sugar industry, where coke is used for the whitening of sugar. Because of an allocation problem, part of the coke use was included in lime production in 2011 (the correct CO_2 emissions should have been 33.30 Gg CO_2 eq in 2011) and this mistake will be corrected in the next submission. The ERT welcomes the planned improved allocation to ensure comparability and time-series consistency and recommends that the Party implement it.

Solvent and other product use – CO_2 and N_2O

61. Sector-specific QA/QC procedures for the solvent and other product use sector were implemented for the first time in the 2013 annual submission. In response to questions raised by the ERT during the review, the European Union provided the checks undertaken and the results of the communications with the member States. The ERT congratulates the EU for this improvement and encourages the Party to continue its implementation.

62. The ERT noted that the United Kingdom reports CO_2 and N_2O emissions from solvent and other product use as "NE" for the complete time series. The ERT encourages the Party to report these emissions.

D. Agriculture

1. Sector overview

63. In 2011, emissions from the agriculture sector amounted to 369,784.65 Gg CO_2 eq, or 10.2 per cent of total GHG emissions. Since 1990, emissions have decreased by 14.8 per cent. The key driver for the fall in emissions is the decrease in the number of cattle and the amount of nitrogen (N)-synthetic fertilizer and manure applied to agricultural soils. Within the sector, 51.6 per cent of the emissions were from agricultural soils, followed by 32.5 per cent from enteric fermentation. Manure management accounted for 15.0 per cent of emissions and rice cultivation accounted for 0.7 per cent. The remaining 0.2 per cent were from field burning of agricultural residues.

64. Prescribed burning of savannas is reported as "NA, NO" in CRF table 4.E but no information is included in the NIR. The ERT recommends that the European Union provide information in the NIR on the occurrence of this category within the Party.

65. Background information regarding emissions calculations was not always included in NIR table 6.84 on CH_4 and N_2O emissions from the field burning of agricultural residues, the activity has not been characterized for Belgium, Germany, Ireland, Luxemburg, Netherlands, Sweden and the United Kingdom of Great Britain and Northern Ireland (i.e. the rows are blank), and in table 6.85 on methodologies used to estimate CH_4 and N_2O emissions from this category, no methodological element but a general description was included for Austria, while for Greece, except the fraction of residues burned on field, no AD, EFs or estimation method were presented. In response to questions raised by the ERT during the review, the Party indicated that, in general, it simply compiles the information in the member States' inventory, and if part of the information is not included in the member State's NIR, it does not create new information. In addition, in the category description-related sections, only parts of the categories for which emissions were

estimated are characterized (e.g. only data and information on cattle, sheep, goats and swine are presented in the NIR section 6.3.1.1, however in CRF table 4 emissions also are reported for buffalo, horses, mules and asses, poultry, and other livestock). The ERT recommends that, for these categories, the European Union improve the procedures for completing the NIR from the data and information provided by member States, and strengthen the collaboration between the European Commission and member States (e.g. in the context of Working Group 1 under the Climate Change Committee and/or dedicated workshop(s) as described in the planned improvements in para. 20 above) so that complete data and information can be included in the NIR for the European Union.

66. The ERT found several areas where there was lack of transparency in the NIR. For example, table 6.61 on relative uncertainty estimates for AD and EFs for rice cultivation includes data only for Greece, Italy and Portugal, although the activity occurs also in France and Spain. In addition, the NIR does not include a section on category-specific planned improvements. The ERT encourages the European Union to use the NIR structure as it is included in the annotated outline of the NIR. The ERT recommends that the Party include in the NIR uncertainty data for all member States and for the European Union at the category level, as well as category-specific planned improvements.

67. The ERT commends the Party for the increased use of higher-tier approaches in comparison to the 2012 annual submission (e.g. for manure management, the percentage of emissions estimated based on a country-specific methodology increased from approximately 63 per cent in the 2012 annual submission to 86 per cent in 2013). The ERT recommends that the European Union further support and encourage member States to develop country-specific AD and EFs in order to allow for increased use of higher-tier approaches.

68. Recalculations were performed for the entire time series (see table 9 below) and are documented in the NIR at the sectoral level. However, only the reasons for recalculations by categories for some member States are included, and it is not clear whether all the reasons for recalculations are reported. In addition, no numerical information by member State on the impact of recalculations per category is included (CRF table 8(b) only refers to member States which performed recalculations). Furthermore, there are inconsistencies in how recalculations are presented in the NIR. For example, a section on the recalculations of CH_4 emissions from field burning of agricultural residues is not included in the NIR, but a section on the recalculations of CH_4 emissions from agricultural soils is (although it includes primarily a discussion on rice cultivation). The ERT reiterates the recommendation made in the previous review report that the Party include in the NIR information on recalculations for all member States that conducted recalculations, including numerical information per member State, and include the rationale and impact of the recalculations on the category. The ERT encourages the European Union to include a specific section in the NIR on the recalculations performed for CH_4 emissions from field burning of agricultural residues and recommends that the Party resolve the error described above in the section on agricultural soils.

2. Key categories

Enteric fermentation – CH_4

69. The ERT noted that sheep and swine population numbers reported in the CRF tables are below the values included by the Food and Agriculture Organization of the United Nations (FAO) (0.6 per cent and 3.5 per cent difference, respectively). In response to a question raised by the ERT during the review, the European Union identified which member States are mainly responsible for the differences (for sheep, Ireland and Portugal are responsible for approximately 80 per cent of the difference and in the case of swine, Germany and Portugal are responsible for over 90 per cent) and provided the rationale for

them. The ERT encourages the European Union, in the context of implementing its verification activities, to include in the NIR the results of the comparison of livestock population data used in the inventory with similar data reported to FAO and Eurostat, together with the description of the potential reasons for differences.

70. The ERT noted that in table 6.20 of the NIR some additional background information on milk production (kg milk/head/day) associated with the CH_4 emissions for dairy cattle are reported as "NA" for the Netherlands, while data which allow their derivation (milk production expressed as kg milk/head/year) are available in the respective member States' NIRs. The ERT recommends that the Party continues its efforts to achieve the completeness and comparability of reported data.

Manure management – CH_4

71. During the review, the Party described a pilot project implemented by Eurostat and member States (in cooperation with JRC) related to animal waste management systems (AWMS). The ERT commends the Party for the extensive discussions held at the European Union level with the goal of developing country-specific parameters for AWMS and housing, as well as the implementation of the pilot project and use by member States of the results. The ERT welcomes the European Union efforts and recommends that the Party continue efforts to develop and implement country-specific data. The ERT encourages the European Union to consider further opportunities to coordinate EU-wide data collection and inventory improvements, including through Working Group 1 under the Climate Change Committee. In addition, the ERT recommends that the European Union report in the NIR on the status and results of further progress in collecting farm-level data.

72. The ERT commends the Party for the inclusion in the NIR of a distinct section on the distribution of livestock by IPCC climate regions, including the comparison of data reported by member States with an independent estimate elaborated by JRC. During the review, the Party presented the need to further assess, perhaps in a workshop setting, the conclusions of the previously presented analysis considering also the uncertainty associated with the model used. The ERT welcomes the Party's initiative to consider further these conclusions, including through workshop(s) and through Working Group 1 under the Climate Change Committee. The ERT recommends that the Party continue the analysis through the collaboration between the JRC, member States, DG CLIMA and EEA, focusing on the differences revealed. In addition, the ERT recommends that the Party, as appropriate, update the member States' livestock allocation to climate regions and associated parameters and report in the NIR on the status and results of any further analysis.

Agricultural soils – N_2O

73. According to table 6.75 in the NIR, N_2O emissions from the cultivation of histosols for Portugal and Ireland were regarded as negligible although in CRF table 4.D the AD and emissions were reported as "NO". In response to a question raised by the ERT during the review, the Party responded that in relation to Portugal the NIR already describes that histosols are at most negligible, which is supported by data available at European Soil Data Centre.[6] Regarding Ireland, the Party responded that based on discussions with experts on agricultural practices and geographic information system analysis, cultivated organic soils are designated as not occurring, that non-permanent grassland is accounted for under cropland, consistent with the definition of arable land temporarily used for forage crops or grazing (page 3.69 of the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF)). The Party also indicated that, in its understanding, the term "cultivated" refers to soil disturbance by ploughing, and that discussions on the term were included within the KP-

[6] <http://eusoils.jrc.ec.europa.eu/wrb>.

LULUCF workshop organized by JRC in November 2013. Additionally, the Party responded that data from FAO on the existence of cultivated organic soils for agricultural purposes might reflect that sometimes countries report data on the drained areas. The ERT recommends that the Party resolve the inconsistencies between the NIR and CRF tables, clarifying whether emissions arise from cultivation of histosols. The ERT commends the Party for the inclusion of a discussion on the meaning of "cultivated" in the JRC KP-LULUCF workshop in November 2013, believing that the term includes more than ploughing, and recommends that the European Union include in the NIR the clarifications provided to the ERT during the review, together with the results of the workshop discussion.

74. The ERT noted a large inter-annual change in the fraction of livestock nitrogen excreted and deposited onto soil during grazing ($Frac_{PRP}$) between 2010 (0.3512) and 2011 (0.3315), the 2011 value being 5.6 per cent lower than 2010. In response to a question raised by the ERT during the review, the European Union indicated that this is due to a mistake resulting from the use of a zero in the $Frac_{PRP}$ to reflect the non-reporting by the United Kingdom. The Party added that the correct value for 2011 is 0.3475, resulting in a 1 per cent decrease. The ERT notes that this error does not lead to an underestimate of emissions, but recommends that the Party include the correct value and improve the implementation of QC procedures in order to prevent such errors.

E. Land use, land-use change and forestry

1. Sector overview

75. In 2011, net removals from the LULUCF sector amounted to 173,992.46 Gg CO_2 eq. Since 1990, net removals have increased by 27.2 per cent. The key drivers for the rise in removals are from the European Union's environmental and agricultural policies, which have encouraged less-intensive agricultural practices and stimulated increased areas of forest and woodland. The greatest increases in net removals were from land converted to forest land and land converted to cropland. A significant impact on net removals from the LULUCF sector was also observed in the reduced net emissions occurring from land converted to grassland and grassland remaining grassland. Within the sector, 270,102.11 Gg CO_2 eq net removals were from forest land, followed by 9,255.08 Gg CO_2 eq from grassland, 3,802.68 Gg CO_2 eq from other land and 2,654.22 Gg CO_2 eq from other (LULUCF). Cropland accounted for net emissions of 75,007.49 Gg CO_2 eq and settlements accounted for net emissions of 34,602.24 Gg CO_2 eq. The remaining net emissions of 2,211.92 Gg CO_2 eq were from wetlands.

76. Following the recommendations made in previous review reports, the Party's 2013 NIR showed improvements in the completeness of the reporting of emissions and removals for all categories and subcategories and of the reporting of all carbon pools. For example, Germany has reported emissions from mineral soils for forest land remaining forest land for the first time. Some mandatory categories, subcategories and carbon pools are still reported as "NE" by member States (e.g. biomass, dead organic matter and carbon in mineral soils for grasslands remaining grasslands). In response to questions raised by the ERT during the review, the European Union explained that the use of the notation key "NE" is carefully monitored and followed up where necessary with the relevant member State. The ERT commends the European Union for the improvements in the reporting and recommends that the Party continue to work with member States with a view to reporting pools which are currently not estimated.

77. In response to the recommendations made in the previous review reports, the description of QA/QC procedures has been further improved. The European Union provided information on its continuous efforts with national LULUCF experts, helping

them in the reporting and facilitating sharing of experiences among member States. The ERT commends the Party for the improvements in QA/QC. The results of QA/QC were also noted by the ERT in the NIR between texts and tables and when comparing to the CRF tables. However, there were still some mistakes in the NIR (e.g. tables 7.10 (see para. 78 below) and 7.20). The ERT recommends that the European Union continue its QA/QC work to improve the overall consistency in the reporting and transparency.

2. Key categories

Forest land remaining forest land – CO_2

78. The area of forest land remaining forest land has slightly increased by 1.6 per cent at the EU-15 level since 1990. About half of the member States reflect the overall trend showing little change since 1990. The largest percentage increases in land area for forest land remaining forest land were in the United Kingdom (26.3 per cent) and in Italy (10.2 per cent), whereas the largest percentage decreases in land area were in Portugal (10.4 per cent) and in the Netherlands (10.2 per cent). The ERT noted that the text in the Party's NIR describing the trends is not consistent with the data provided in the CRF tables and in table 7.10 in the NIR. Although the ERT commends the European Union for the improvements in the reporting of the reasons for inter-annual variation in removals in the NIR it reiterates the recommendation made in the previous review report to improve the accuracy and consistency between the NIR and the CRF tables.

79. At the EU-15 level this category was a net sink of 227,507.99 Gg CO_2 eq in 2011, which represents a decrease of 1.3 per cent from 1990 levels and a 5.0 per cent increase from 2010. Austria, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, Portugal and the United Kingdom show fluctuating trends in net CO_2 emissions and removals, while the remainder show more steady trends. The NIR provides information on the reasons, by pool, for the inter-annual variation but the description is not fully transparent to let the ERT assess the consistency of the time-series. When member States' emissions are aggregated to the EU-15 level the inter-annual variation is averaged out showing relatively constant removals. The ERT recommends that the European Union work to improve the transparency in the NIR.

Land converted to forest land – CO_2

80. The European Union reports that the area of land converted to forest land in 2011 was 6,604.24 kha, which is 5.3 per cent of the total forest area, and increased by 51.5 per cent since 1990. Italy reports the largest area (1,560.76 kha), which is 23.6 per cent of the EU-15 total. The largest increases in the area were in Spain, Italy, France and Ireland, while the largest decrease was in the United Kingdom. At the EU-15 level, for 2011, land converted to forest land is reported as a net removal of 43,743.50 Gg CO_2 and in 2010, a sink of 46,658.62 Gg CO_2, with an increase of 98.4 per cent since 1990 (net removals were 22,045.26 Gg CO_2). Correction of a mistake in emission calculations by Italy resulted in an increase in net removals to 7,338.63 Gg CO_2 in 2010, compared to the previous annual submission where the sink was reported as 1,189.69 Gg CO_2. The ERT commends the European Union for the improvements in the accuracy of its reporting. However, the ERT noted that the reporting of the changes in net removals was not transparent in the NIR, especially for Italy. In response to a question raised by the ERT during the review, the Party explained that Italy calculates the emissions for the entire forest land and then splits the sink proportional to the areas of forest land remaining forest land and land converted to forest land. The JRC further acknowledged that this approach may not be satisfactory because the assumption of an equal sink between lands remaining forest land and lands converted to forest land is not justified. The ERT recommends that the Party work with Italy on the methodology, since it is not reasonable to consider emissions/removals from

land converted to forest land and forest land remaining forest land to be the same because increment and harvest values are likely to be very different in newly established forests.

Land converted to cropland – CO_2

81. The area of land converted to cropland has decreased by 22.2 per cent since 1990 for the EU-15. The converted area in 2011 was 8.0 per cent of the total cropland area. Conversion from grassland covers most of the area, which accounts for 5,845.78 kha of the total converted area of 6,804.05 kha in 2011. France and the United Kingdom reported the largest areas (3,778.12 kha and 1,309.01, respectively). Total emissions at the EU-15 level in 2011 were 30,145.34 Gg CO_2 compared with emissions from cropland remaining cropland, which were 42,056.27 Gg CO_2. The ERT noted that some member States reported pools using only a lower-tier method (e.g. Ireland, Italy, Luxemburg and Netherlands) and some reporting was incomplete (e.g. soil organic carbon on mineral soils in the Netherlands). The ERT reiterates the recommendation made in the previous review report that the Party continue to work with the member States to improve the completeness of their reporting and use higher tiers.

82. According to the NIR (page 354), Spain does not account for CO_2 emissions from lime production in sugar mills because it is captured in a by-product used for soil improvement. At sugar plants producing lime as a non-marketed intermediate, 90 per cent of the carbonates contained in the raw material are fed into the kiln and are partly retained in a by-product from the production process, the carbonation foam (the remaining 10 per cent of emissions are reported under lime production). In response to questions raised by the ERT during the review, Spain indicated that research is underway into the destination and application of the carbonation foam, so as to close the carbonate cycle starting from the use of limestone in the kiln for sugar production. The ERT noted that there might be an underestimation of emissions in agricultural lime application if this lime is applied to cropland or grassland (see para. 99 below). The ERT recommends that the European Union work with Spain to ensure that these emissions from lime application are reported transparently under the LULUCF sector and the KP-LULUCF activities.

Grassland remaining grassland – CO_2

83. The reported area under this subcategory in 2011 (53,351.25 kha) is 6.2 per cent less than in 1990 (56,905.64 kha). The category was a small source of emissions in 2011, amounting to 11,089.64 Gg CO_2. The major contributors to the emissions were Germany (10,325.49 Gg CO_2) and the Netherlands (4,246.00 Gg CO_2). The emissions have decreased by 47.1 per cent from 1990, mainly as a result of decreases in Italy and the United Kingdom. The carbon stock change (CSC) in mineral soils was reported as "NE" by Spain and several member States report "NO" for this category (e.g. France reports no change in all pools based on country-specific datasets). Some member States report changes in the soil carbon pool but assume no change in living biomass or dead organic matter pools, assuming a steady state, which is in line with IPCC good practice guidance for LULUCF. The ERT reiterates the recommendations made in the previous review reports that the European Union support member States in improving the completeness of their reporting and also recommends that the Party ensure that the assumptions and methods are transparently described in the NIR.

84. There was also large inter-annual variability in the net CSC in living biomass in several years (e.g. in 2007 the net CSC was 0.0017 Mg C/ha and in 2008 0.0110 Mg C/ha). In response to a question raised by the ERT during the review, the Party responded that the main contributor to the inter-annual change is Italy, which includes estimates from other wooded land under this subcategory, causing variation. The European Union indicated its intent to work further with Italy on grassland issues. The ERT commends the European Union for its efforts to improve the transparency of member States' reporting. The ERT

recommends that the Party work with Italy on its reporting of CSC in living biomass and document the reasons for fluctuations in the NIR.

3. Non-key categories

Land converted to other land – CO_2

85. There were large inter-annual fluctuations in CO_2 emissions in this category. For example, the European Union reported net removals of 2,605.55 Gg CO_2 in 2009 and net removals of 3,606.26 Gg CO_2 in 2010. The Party reported net removals of 3,804.26 Gg CO_2 in 2011 but net emissions of 1,656.68 Gg CO_2 in 1990. The inconsistency in the time series was also observed in the net CSC in living biomass (e.g. the Party reported a net CSC of –0.1796 Mg C/ha in 2009 and –0.0771 Mg C/ha in 2010). In response to questions raised by the ERT during the review, the Party explained that the inconsistency originated from Portugal, whose national system for reporting was under development. The area reported by Portugal increased from 69.58 kha in 1990 to 1,033.85 kha in 2011, which partly explains the trend at the European Union level. Increases in other land are mostly explained by agriculture abandonment and degradation of forests to non-forest land, mostly due to recurring forest fires. Part of the inter-annual variation is also explained by France, which reports a higher IEF for 2009 and 2010 corresponding to country-specific biomass data. The ERT recommends that the European Union transparently explain significant inter-annual fluctuations and also work with member States to improve the consistency of their reporting.

F. Waste

1. Sector overview

86. In 2011, emissions from the waste sector amounted to 101,941.38 Gg CO_2 eq, or 2.8 per cent of total GHG emissions. Since 1990, emissions have decreased by 40.7 per cent. The key drivers for the fall in emissions are the European Union policy on waste, which focused on reduction in waste sent to landfills, and the increase of landfill gas recovery. Within the sector, 74.9 per cent of the emissions were from solid waste disposal on land, followed by 20.4 per cent from wastewater handling and 2.7 per cent from waste incineration. The remaining 2.0 per cent were from other (waste), specifically from biological treatment of waste.

87. The notation key "NE" was reported in the CRF tables for some of the parameters (e.g. methane correction factor (MCF), waste generation rate and degradable organic carbon (DOC) for solid waste disposal on land) and AD (for wastewater handling) and for some additional information (e.g. CH_4 oxidation factor and fraction of DOC in solid waste disposal sites). In response to a question raised by the ERT during the review, the Party explained that the reason for this is the heterogeneity of the data reported by the member States, which cannot easily be compared. The ERT notes that provision of AD aids transparency and comparison of inventories and therefore the ERT recommends that the Party improve the reporting of AD by including European Union-level AD in the CRF tables and provide detailed information of AD at the member State level in the NIR noting the need to clearly identify each dataset (see para. 23 above).

2. Key categories

Solid waste disposal on land – CH_4

88. All EU-15 member States used the IPCC tier 2 first order decay method with a combination of default and country-specific EFs for estimating CH_4 emissions, in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. The category

covers solid waste disposal on land both to managed and unmanaged waste disposal sites. The ERT noted an inconsistency between table 8.2 and table 8.14 of the NIR regarding the tier used to estimate emissions in Luxembourg (table 8.2 reports the method applied as tier 2 while table 8.14 reports tier 1). In response to a question raised by the ERT during the review, the Party explained that Luxembourg uses the tier 1 method from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines), which is a first order decay model with default parameters, so, in the context of the Revised 1996 IPCC Guidelines and the IPCC good practice guidance the method could be classified as tier 2. The ERT recommends that the Party improve the consistency in the NIR related to the methodological tier applied by Luxembourg.

Wastewater handling – CH_4 and N_2O

89. The ERT noted that, according to the NIR, only 5 per cent of the N_2O emissions and 9 per cent of the CH_4 emissions where estimated using higher-tier methodologies, as recommended by the IPCC good practice guidance for key categories. In response to a question raised by the ERT during the review, the Party explained that the share of higher tiers used by the member States is probably higher than that included in the European Union NIR (and as reported by the member States) owing to the unclear definition in the guidelines of tiers. The ERT reiterates the recommendation made in the previous review report that the European Union improve the consistency of reporting the tier methods used by the member States.

90. Ten member States reported CH_4 emissions from industrial wastewater treatment (Finland, France, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, United Kingdom) and five member States used notation keys (Austria, Germany and Belgium: "NA"; Luxembourg: "NO"; and Denmark: "IE"). In response to a question raised by the ERT during the review regarding the reasons for the use of notation keys, the European Union provided appropriate explanations for each member State. For example, in the case of Austria, "NA" is reported because although Austria has wastewater treatment facilities, treatment is either under aerobic conditions or CH_4 recovery is installed and therefore there are no emissions. The ERT recommends that the Party include explanations for the use of the notation keys to improve the transparency of its report.

3. Non-key categories

Waste incineration – CO_2, CH_4 and N_2O

91. Ten member States used the method from the Revised 1996 IPCC Guidelines and the IPCC good practice guidance, the core inventory of air emissions (CORINAIR) or country-specific methods with both country-specific and default EFs for estimating emissions from waste incineration. Emissions from waste incineration were reported by ten member States (Austria, Belgium, France, Greece, Italy, Portugal, Spain, Sweden, Ireland and United Kingdom), while three member States (Finland, Luxemburg and Netherlands) reported such emissions as "IE" and two member States (Denmark and Germany) reported them as "NO". The ERT noted that the European Union reported CO_2 emissions from waste incineration as "NO" for Denmark in table 8.12 of the NIR, however, in the same table GHG emissions as a whole are reported for incineration in Denmark. In response to a question raised by the ERT during the review, the Party explained that Denmark reports CO_2 emissions from biogenic waste incineration (corpses and carcasses) in CRF table 6.A,C, however emissions from fossil waste incineration do not occur since all incinerators work with energy recovery. Thus the CO_2 emissions are reported under waste incineration as "NO" but the CH_4 and N_2O emissions from the cremation of corpses and carcasses are accounted, therefore GHG emissions are estimated for incineration. The ERT recommends that the Party include this information in the NIR.

Other (waste) – CH_4 and N_2O

92. The member States used the default method from the 2006 IPCC Guidelines or country-specific methods with both country-specific and default EFs for estimating emissions from the biological treatment of waste. Emissions from the biological treatment of waste were reported by ten member States (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Italy, Luxemburg and Netherlands). The other subcategories considered under other (waste) are: biogas production (reported by Denmark, France and Spain); sludge spreading (Italy and Spain); accidental fires and other combustion of waste, including burning of yard waste and wildfires (Denmark); and mechanical–biological waste treatment plants (Germany). The ERT commends the European Union for reporting emissions from these subcategories. However, the ERT encourages the European Union to use the documentation box in CRF table 6 to provide information regarding activities covered under this category and to provide reference to the section in the NIR where background information can be found.

G. Supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol

1. Information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

Overview

93. Table 6 provides an overview of the information reported and parameters selected by the European Union under Article 3, paragraphs 3 and 4, of the Kyoto Protocol.

Table 6
Supplementary information reported under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

		Findings and recommendations
Has the Party reported information in accordance with the requirements in paragraphs 5–9 of the annex to decision 15/CMP.1?	Sufficient	97, 99
Identify any elected activities under Article 3, paragraph 4, of the Kyoto Protocol	Forest management, cropland management and grazing land management Years reported: 1990, 2008, 2009, 2010 and 2011	
Identify the period of accounting	Commitment period accounting	
Assessment of the Party's ability to identify areas of land and areas of land-use change	Sufficient	

Activities under Article 3, paragraph 3, of the Kyoto Protocol

Afforestation/reforestation–CO_2

94. Most of the area reported in 2011 as afforestation/reforestation land (6,705.36 kha) is located in Italy (1,716.15 kha), France (1,240.74 kha) and Spain (1,111.14 kha). These three member States account for 60.7 per cent of the total reported area by the EU-15. The highest levels of removals were reported by France (8,414.49 Gg CO_2), Portugal (7,142.11 Gg CO_2), Italy (6,481.98 Gg CO_2) and Spain (6,445.50 Gg CO_2). These member States achieved 62.3 per cent of the total net sink of the EU-15 from afforestation/reforestation

activities in 2011. Portugal introduced significant changes in the land representation system and, in Italy, a new method was introduced. Compared with the previous annual submission, removals increased by 5,722.69 Gg CO_2 for 2010.

95. In a response to a question raised by the ERT during the review about Italy's assumption of equal sink in afforested and other forest land (see para. 80 above) the Party explained that the methodology is the same as that used under Convention reporting. Since increments and harvesting rates are very likely to be different under afforestation and forest management, the ERT finds that this assumption is not justified. Therefore the ERT refers to the recommendation made under land converted to forest land (see para. 80 above) and recommends that the Party work with Italy on the methodology.

Deforestation – CO_2

96. Portugal and France report the largest areas of deforestation, 831.64 kha and 820.99 kha respectively. Together with Finland, Sweden and Germany they are the main contributors to deforestation in the European Union, accounting for 82.2 per cent of the total reported area of EU–15 deforestation. All member States reported net emissions for this activity. France is responsible for the greatest share of the total emissions (41.8 per cent). The ERT commends the Party for improving the reporting of litter (Finland and Greece), and mineral soils and dead wood pools (Greece), as these pools were reported for the first time in the 2013 annual submission. The ERT notes, however, that Finland continues to report "NE" for carbon stock change in litter resulting from conversion to wetlands peat. In response to a question raised by the ERT during the review, the European Union indicated that Finland reports the notation key "NE" for the CSC where there is no method in the IPCC good practice guidance for LULUCF. However, the ERT notes that the annex to decision 16/CMP.1 requires all pools to be reported for any relevant activity, and deforestation is a mandatory activity. Therefore the ERT strongly reiterates the recommendation made in the previous review report that the Party work with member States to improve the completeness of their reporting.

Forest management – CO_2

97. The member States, except Spain, Greece and Italy, reported CSC for all pools. Spain and Greece reported "NE" for CSC in litter, dead wood and mineral soils. Italy reported "NE" for CSC in mineral soils. The ERT commends the European Union for the improvements in the transparency of the NIR, providing justifications for omitting carbon pools from member States' reporting (table 11.13). However, the ERT reiterates the recommendation made in the previous review report that the European Union work with member States to prepare more complete information on the justifications for "not a net source" provided by each member State.

98. Most member States considered all national forest area as subject to the "forest management" activity; however, a few considered it only partially subject to forest management (e.g. France reports 3 per cent of forests as unmanaged and Greece reports only a third of its forest land areas under forest management). The reasoning and justification for reporting only part of forests as managed is not transparently explained in the NIR. The ERT strongly recommends that the European Union work with these member States to ensure that emissions from the forest management activity are not underestimated due to part of forest land considered as unmanaged.

Cropland management – CO_2

99. Only three member States elected this activity; Denmark, Portugal and Spain. Spain reported net removals, whereas the others reported net emissions from this activity in 1990, 2008, 2009, 2010 and 2011. Spain has reported "NE" for CSC in litter and dead wood. As discussed in paragraph 82 above, Spain produces lime as a by-product from sugar refineries

and allocates 10 per cent of emissions under the industrial processes sector and assumes that the remaining 90 per cent is applied to soils (although the exact destination is not known). As described above, the ERT strongly recommends that the European Union work with Spain on this issue to determine whether there are CO_2 emissions from lime application and, if so, under which KP-LULUCF activity (or activities) or sector the remaining 90 per cent of lime should be allocated. The ERT also strongly reiterates the recommendation made in the previous review report that the Party work with Spain to provide more transparent and verifiable information in the NIR that litter and dead wood pools are not a net source of emissions.

2. Information on Kyoto Protocol units

Standard electronic format and reports from the national registry

100. The European Union has reported information on its accounting of Kyoto Protocol units in the required SEF tables, as required by decisions 15/CMP.1 and 14/CMP.1. The ERT took note of the findings included in the standard independent assessment report (SIAR) on the SEF tables and the SEF comparison report.[7] The SIAR was forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings and recommendations contained in the SIAR.

101. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with decision 15/CMP.1, annex, chapter I.E, and reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent with that contained in the national registry and with the records of the international transaction log (ITL) and the clean development mechanism registry and meets the requirements referred to in decision 22/CMP.1, annex, paragraph 88(a–j). The transactions of Kyoto Protocol units initiated by the national registry are in accordance with the requirements of the annex to decision 5/CMP.1 and the annex to decision 13/CMP.1. No discrepancy has been identified by the ITL and no non-replacement has occurred. The national registry has adequate procedures in place to minimize discrepancies.

Calculation of the commitment period reserve

102. The European Union has reported its commitment period reserve in its 2013 annual submission. The European Union reported that its commitment period reserve has not changed since the initial report review (17,659,243,358 t CO_2 eq) as it is based on the assigned amount and not the most recently reviewed inventory.

3. Changes to the national system

103. The European Union reported that there are no changes in its national system since the previous annual submission. The ERT concluded that the Party's national system continues to be in accordance with the requirements of national systems outlined in decision 19/CMP.1.

4. Changes to the national registry

104. The European Union reported that there are changes in its national registry since the previous annual submission. The Party described the changes, specifically due to the centralization of the EU ETS operations into a single European Union registry operated by the European Commission called the Consolidated System of EU registries (CSEUR), in its

[7] The SEF comparison report is prepared by the international transaction log (ITL) administrator and provides information on the outcome of the comparison of data contained in the Party's SEF tables with corresponding records contained in the ITL.

NIR (see page 877). The CSEUR is a consolidated platform which implements the national registries in a consolidated manner and was developed together with the new European Union registry.

105. The ERT noted that there were recommendations in the SIAR that had not been addressed related to the CSEUR, in particular recommendations related to reporting a description of the changes in database structure and reporting of test results. In response to questions raised by the ERT during the review, the European Union provided further confidential information on the changes to the national registry, including a description of the changes in database structure and reporting of test results.

106. The ERT concluded that, taking into account the confirmed changes in the national registry, including additional information provided to the ERT during the review, the European Union's national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1 and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP) decisions. With respect to the provision of information related to database structure specifically, the ERT encourages the Party to provide additional information in the NIR. The ERT recommends that the European Union include all other additional information in response to the SIAR findings in its NIR in accordance with decision 15/CMP.1, annex, chapter I.G.

5. Minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol

107. The European Union reported that there are changes in its reporting of the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol since the previous annual submission. The Party described the changes related to biofuels and energy policies in its NIR. The ERT concluded that, taking into account the confirmed changes in the reporting, the information provided is complete and transparent.

108. In October 2012 a new European Commission proposal was published to limit global land conversion for biofuel production, and raise awareness of the climate benefits of biofuels used in the European Union. The European Commission continues its efforts to promote second- and third-generation biofuels, shifting away from fuels based on food crops. In this light, it recently put forward a proposal to limit to 5 per cent the use of food-based fuels in meeting the European Union renewable energy target in transport.

109. In March 2013 the European Commission published a Green Paper ("A 2030 framework for climate and energy policies") to reflect a new 2030 framework for climate and energy policies. The European Union believes that it has a clear framework to steer its energy and climate policies up to 2020, and this Green Paper provides clarity on a policy framework up to 2030.

110. The second call for proposals of the African, Caribbean and Pacific Group of States (ACP)-EU Energy Facility with a budget of EUR 55 million was also launched. The deadline for submission of concept notes and full applications was 6 March 2013. The second ACP-EU Energy Facility is one of the instruments implementing the Africa-EU Energy Partnership, which is part of the 2011–2013 Joint Africa-EU Strategy. A specific website for the monitoring of the ACP-EU Energy Facility was created.[8]

[8] <http://www.energyfacilitymonitoring.eu/>.

III. Conclusions and recommendations

A. Conclusions

111. Table 7 summarizes the ERT's conclusions on the 2013 annual submission of the European Union, in accordance with the Article 8 review guidelines.

Table 7
Expert review team's conclusions on the 2013 annual submission of the European Union

		Paragraph cross-references
The ERT concludes that the inventory submission of the European Union is complete (categories, gases, years and geographical boundaries and contains both an NIR and CRF tables for 1990–2011)		
Annex A sources[a]	Not complete	Table 3
LULUCF[a]	Not complete	Table 3
KP-LULUCF	Not complete	Table 3, 96
The ERT concludes that the inventory submission of the European Union has been prepared and reported in accordance with the UNFCCC reporting guidelines	Yes	45
The submission of information required under Article 7, paragraph 1, of the Kyoto Protocol has been prepared and reported in accordance with decision 15/CMP.1	Yes	
The Party's inventory is in accordance with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*	Yes	Table 3, 89
The European Union has reported information on Article 3, paragraphs 3 and 4, of the Kyoto Protocol	Yes	95–99
The European Union has reported information on its accounting of Kyoto Protocol units in accordance with decision 15/CMP.1, annex, chapter I.E, and used the required reporting format tables as specified by decision 14/CMP.1	Yes	
The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1	Yes	
The national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1 and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant CMP decisions	Yes	106
Did the Party provide information in the NIR on changes in its reporting of the minimization of adverse impacts in accordance	Yes	

	Paragraph cross-references
with Article 3, paragraph 14, of the Kyoto Protocol?	

Abbreviations: Annex A sources = sources included in Annex A to the Kyoto Protocol, CMP = Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol, CRF = common reporting format, ERT = expert review team, IPCC = Intergovernmental Panel on Climate Change, LULUCF = land use, land-use change and forestry, KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NIR = national inventory report, UNFCCC reporting guidelines = "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories".

[a] The assessment of completeness by the ERT considers only the completeness of reporting of mandatory categories (i.e. categories for which methods and default emission factors are provided in the Intergovernmental Panel on Climate Change (IPCC) *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, or the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry*).

B. Recommendations

112. The ERT identified the issues for improvement listed in table 8. All recommendations are for the next annual submission, unless otherwise specified.

Table 8
Recommendations identified by the expert review team

Sector	*Category*	*Recommendation*	*Paragraph cross-reference*
Cross-cutting		Strengthen the system to check whether a category is really not estimated as opposed to not occurring, and if the activity occurs, report emissions for the respective member State to ensure complete reporting	Table 3
		Review the use of the notation keys for "not estimated" and either revise the notation key or ensure emissions are estimated	
		Improve the quality assurance/quality control (QA/QC) of the NIR, considering both internal consistency and consistency with the CRF tables	
	Inventory planning	Ensure that all contracts and agreements are in place and that continuity is assured	12
		Ensure that any errors identified during the compilation of the European Union inventory from the inventories of the member States be addressed in a timely manner	16
	Inventory preparation	Check tables containing information on tiers and sources of emission factors (EFs) and ensure that: all member States' methods are correctly and consistently classified where tiers are provided in the Revised 1996 IPCC Guidelines or the IPCC good practice guidance; all codes used in the table are explained in the section *Units and abbreviations*; and references to sources such as CORINAIR are included	22

		Improve the reporting of AD by using data representing the Party as a whole and, together with total Party emissions, estimate the Party's implied emission factors (IEFs)	23
		Use a single official UN language in a future NIR of the European Union	24
	Follow up to previous reviews	Encourage all member States to improve the completeness of their inventories, particularly for the LULUCF sector and KP-LULUCF activities	27
		Make efforts to summarize the country-specific subcategories reported by the member States and report a list of the subcategories reported under the category other in the CRF tables	28
Energy	Sector overview	Continue efforts to ensure consistent reporting across member States regarding methods and EFs	31
		Strengthen QA/QC procedures to ensure that member States' information is updated and correctly represented in the NIR	32
		Further encourage consistency of reporting of fuels across member States and, where relevant (e.g. where there are deviations of the IEFs due to the misallocation of a fuel by different member States), include a table summarizing the allocation of fuels across subcategories and sectors among member States (e.g. allocation across the energy and industrial processes sectors, and allocation of biomass across member States)	33
	Comparison of the reference approach with the sectoral approach and international statistics	Explain why the weighted average of the carbon stored fractions of the member States is not used for all fuels	35
		Use a consistent methodology for the entire time series or further justify the current approach	35
Industrial processes and solvent and other product use	Sector overview	Explore ways to replace the use of notation keys with actual values in background data	44
	Limestone and dolomite use – CO_2	Correct the incomplete AD or provide an explanation of the IEF trend in the NIR	49
	Ammonia production – CO_2	Provide a more detailed description of the amount of CO_2 recovered during the ammonia production process in Belgium, its allocation in the inventory, and how the completeness of the reporting is ensured	51

		Provide more information to justify the decreasing IEF in the United Kingdom, including why the carbon is assumed to be stored long-term, and provide additional information on the activity data (AD) and emissions data used	52
	Other (chemical industry) – CO_2 and CH_4	Provide explanation to justify the use of the notation key for not applicable ("NA") for Spain	53
		Provide information on how the oxidation factors for industrial gases and carbon electrodes are derived	54
	Production of halocarbons and SF_6 – HFCs	Ensure that Italy includes HFC-23 emissions from HCFC-22 production in its subsequent annual submissions	56
		Ensure the most accurate estimate possible is developed for 2010 for Spain and time series consistency is ensured	57
	Consumption of halocarbons and SF_6 – HFCs	Document in the NIR the non-existence of HFC emissions from fire extinguishers in Denmark and Luxembourg	58
		Implement planned improvements to estimate HFC emissions from solvents for France and the United Kingdom for 2011 or provide a justification as to why the current estimates are an accurate assessment of emissions	59
	Other production – CO_2	Reallocate CO_2 emissions from coke use for food and drink from lime production to other production for 2011	60
Agriculture	Sector overview	Provide information in the NIR on the occurrence of prescribed burning of savannas within the Party	64
		Improve the procedures for completing the NIR from the data and information provided by member States, and strengthen the collaboration between the European Commission and member States	65
		Include in the NIR uncertainty data for all member States and for the European Union at the category level, as well as category-specific planned improvements	66
		further support and encourage member States to develop country-specific AD and EFs in order to allow for increased use of higher-tier approaches	67
		Include in the NIR information on recalculations for all member States that conduct recalculations, including numerical information per member State, and include the rationale and impact of the recalculations	68
		Resolve the error in reporting of recalculations in the agricultural soils section	68
	Enteric fermentation –	Ensure completeness of reporting of background data for	70

	CH_4	the Netherlands for milk production	
	Manure management – CH_4	Continue efforts to develop and implement country-specific data for animal waste management systems	71
		Report in the NIR on the status and results of further progress in collecting farm-level data	71
		Continue the analysis on the distribution of livestock by Intergovernmental Panel on Climate Change climate regions, through the collaboration between the JRC, member States, DG CLIMA and EEA, focusing on the differences revealed	72
		As appropriate, update the member States' livestock allocation to climate regions and associated parameters and report in the NIR on the status and results of any further analysis	72
	Agricultural soils – N_2O	Resolve inconsistencies between the NIR and CRF tables, clarifying whether emissions arise from cultivation of histosols	73
		Include in the NIR clarifications provided to the expert review team during the review regarding the meaning of the term "cultivated", together with the results of the related workshop discussion	73
		Include the correct value for the fraction of livestock nitrogen excreted and deposited onto soil during grazing and improve the implementation of QC procedures	74
LULUCF	Sector overview	Continue to work with member States with a view to reporting pools which are currently not estimated	76
		Continue QA/QC work	77
	Forest land remaining forest land – CO_2	Improve the accuracy and consistency between the NIR and the CRF tables regarding the trends	78
		Improve transparency in the NIR on the discussion of trends	79
	Land converted to forest land – CO_2	Work with Italy on estimating emissions, in particular Italy's current method to split the sink proportional to the areas of forest land remaining forest land and land converted to forest land	80
	Land converted to cropland – CO_2	Continue to work with the member States to improve the completeness of their reporting and use higher tiers	81
		Work with Spain to ensure that emissions from lime application are reported transparently under the LULUCF sector and the KP-LULUCF activities	82

	Grassland remaining grassland – CO_2	Support member States in improving completeness of their reporting	83
		Ensure that the assumptions and methods are transparently described in the NIR	83
		Work with Italy on its reporting of carbon stock change in living biomass and document the reasons for fluctuations in the NIR	84
	Land converted to other land – CO_2	Transparently explain significant inter-annual fluctuations and work with member States to improve the consistency of their reporting	85
Waste	Sector overview	Include European Union-level AD in the CRF tables and provide detailed information of AD at the member State level in the NIR noting the need to clearly identify each dataset	87
	Solid waste disposal on land – CH_4	Improve the consistency in the NIR related to the methodological tier applied by Luxembourg	88
	Wastewater handling – CH_4 and N_2O		89
		Improve the consistency of reporting the tier methods used by the member States	
		Include explanations for the use of the notation keys for industrial wastewater treatment	90
	Waste incineration – CO_2, CH_4 and N_2O	Include information in the NIR to explain Denmark's reporting of GHG emissions from fossil waste incineration.	91
KP-LULUCF	Afforestation/ reforestation – CO_2	Work with Italy on estimating emissions, in particular Italy's current method to split the sink proportional to the areas of forest land remaining forest 'and and land converted to forest land	95
	Deforestation	Work with member States to improve the completeness of their reporting	96
	Forest management – CO_2	Work with member States to prepare more complete information on the justifications for "not a net source" provided by each member State	97
		Work with France and Greece to ensure that emissions from the forest management activity are not underestimated due to part of forest land being considered unmanaged	98
	Cropland management – CO_2	Work with Spain to determine whether there are CO_2 emissions from lime application and, if so, under which KP-LULUCF activity (or activities) or sector the remaining 90 per cent of lime should be allocated	99

	Work with Spain to provide more transparent and verifiable information in the NIR that litter and dead wood pools are not a net source of emissions	99
National registry	Include all other additional information in response to the SIAR findings in its NIR in accordance with decision 15/CMP.1, annex, chapter I.G	106

Abbreviations: AD = activity data, CRF = common reporting format, DG Clima = Directorate-General for Climate Action, EEA = European Environment Agency, EF = emission factor, IEF = implied emission factor, JRC = Joint Research Centre, KP-LULUCF = land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol, NIR = national inventory report, UN = United Nations, QA/QC = quality assurance/quality control.

IV. Questions of implementation

113. No questions of implementation were identified by the ERT during the review.

Annex I

Background data on recalculations and information to be included in the compilation and accounting database

Table 9
Recalculations in the 2013 annual submission for the base year and the most recent

Greenhouse gas source and sink categories	*1990*	*2010*	*1990*	*2010*	*Reason for the recalculation*
	Value of recalculation (Gg CO_2 eq)		*Per cent change*		
1. Energy	4 054.87	5 942.58	0.1	0.2	Changes in AD, EF and methods
A. Fuel combustion (sectoral approach)	4 155.18	6 380.12	0.1	0.2	
1. Energy industries	–1 708.34	1 249.11	–0.1	0.1	
2. Manufacturing industries and construction	4 995.53	382.41	0.8	0.1	
3. Transport	599.15	612.94	0.1	0.1	
4. Other sectors	–23.11	3 787.19	0.0	0.6	
5. Other	291.95	348.47	1.3	4.9	
B. Fugitive emissions from fuels	–100.31	–437.54	–0.1	–0.9	
1. Solid fuels	40.13	283.18	0.1	3.7	
2. Oil and natural gas	–140.44	–720.72	–0.3	–1.9	
2. Industrial processes	–3.57	–3 963.51	0.0	–1.5	Changes in AD, EF and methods
A. Mineral products	489.29	607.54	0.4	0.7	
B. Chemical industry	-391.64	–1 017.87	–0.3	–2.2	
C. Metal production	–123.51	168.42	–0.2	0.4	
D. Other production					
E. Production of halocarbons and SF_6		–12.22		–0.4	
F. Consumption of halocarbons and SF_6	22.29	–3 709.30	0.3	–4.8	
G. Other		–0.05		0.0	
3. Solvent and other product use	–270.18	–1 362.66	–2.0	–14.2	Changes in AD, EF and methods
4. Agriculture	172.32	–4 317.62	0.0	–1.2	Changes in AD, EF and methods
A. Enteric fermentation	2 620.83	–553.59	1.9	–0.5	
B. Manure management	–2 742.77	–3 905.91	–4.3	–6.4	
C. Rice cultivation		–6.67		–0.3	
D. Agricultural soils	29' 81	149.32	0.1	0.1	
E. Prescribed burning of savannas					
F. Field burning of agricultural residues	2.46	–0.77	0.2	–0.1	
G. Other					

Greenhouse gas source and sink categories	*1990*	*2010*	*1990*	*2010*	*Reason for the recalculation*
	Value of recalculation (Gg CO_2 eq)		*Per cent change*		
5. Land use, land-use change and forestry	29 666.04	8 139.30	17.8	4.6	Changes in AD, EF and methods
A. Forest land	–501.13	–5 644.58	–0.2	–2.2	
B. Cropland	22 971.63	15 720.77	39.0	28.1	
C. Grassland	7,816.77	2 098.51	810.0	18.2	
D. Wetlands	–346.31	41.25	–11.9	2.0	
E. Settlements	–1 656.75	–985.20	–6.0	–2.8	
F. Other land	1 381.83	–3 349.22	499.5	–1 311.0	
G. Other		257.77		7.5	
6. Waste	1 205.88	–3 687.14	0.7	–3.4	Changes in AD, EF and methods
A. Solid waste disposal on land	349.08	–3 751.39	0.2	–4.5	
B. Wastewater handling	826.06	–263.88	3.6	–1.3	
C. Waste incineration	35.08	325.76	0.8	12.1	
D. Other	–4.92	2.38	–0.9	0.1	
7. Other					
Total CO_2 equivalent without LULUCF	**5 159.33**	**–7 388.35**	**0.1**	**–0.2**	
Total CO_2 equivalent with LULUCF	**34 825.37**	**750.95**	**0.9**	**0.0**	

Abbreviations: AD = change in activity data, EF = change in emission factors, LULUCF = land use, land-use change and forestry.

Table 10
Information to be included in the compilation and accounting database in t CO_2 eq for 2011, including the commitment period reserve

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Commitment period reserve	17 659 243 358			17 659 243 358
Annex A emissions for 2011				
CO_2	3 002 815 356			3 002 815 356
CH_4	287 160 162			287 160 162
N_2O	260 402 798			260 402 798
HFCs	70 745 427	70 745 544		70 745 544
PFCs	3 460 728			3 460 728
SF_6	6 072 748			6 072 748
Total Annex A sources	3 630 657 218	3 630 657 335		3 630 657 335
Activities under Article 3, paragraph 3, for 2011				
3.3 Afforestation and reforestation on non-harvested land for 2011	–47 215 281			–47 215 281
3.3 Afforestation and reforestation on harvested land for 2011	1 548 488			1 548 488
3.3 Deforestation for 2011	27 456 754			27 456 754
Activities under Article 3, paragraph 4, for 2011[c]				
3.4 Forest management for 2011	–215 247 364			–215 247 364
3.4 Cropland management for 2011	827 464			827 464
3.4 Cropland management for the base year	9 600 255			9 600 255
3.4 Grazing land management for 2011	–430 029			–430 029
3.4 Grazing land management for the base year	2 218 922			2 218 922
3.4 Revegetation for 2011				
3.4 Revegetation in the base year				

Abbreviation: Annex A sources = sources included in Annex A to the Kyoto Protocol.
[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustments.
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 11
Information to be included in the compilation and accounting database in t CO_2 eq for 2010

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2010				
CO_2	3 155 308 447			3 155 308 447
CH_4	293 458 501			293 458 501
N_2O	262 770 370			262 770 370
HFCs	69 310 921			69 310 921
PFCs	3 192 575			3 192 575
SF_6	6 183 843			6 183 843
Total Annex A sources	3 790 224 658			3 790 224 658
Activities under Article 3, paragraph 3, for 2010				
3.3 Afforestation and reforestation on non-harvested land for 2010	–47 840 994			–47 840 994
3.3 Afforestation and reforestation on harvested land for 2010	1 719 644			1 719 644
3.3 Deforestation for 2010	27 834 812			27 834 812
Activities under Article 3, paragraph 4, for 2010[c]				
3.4 Forest management for 2010	–205 081 672			–205 081 672
3.4 Cropland management for 2010	1 480 184			1 480 184
3.4 Cropland management for the base year	9 600 255			9 600 255
3.4 Grazing land management for 2010	–267 131			–267 131
3.4 Grazing land management for the base year	2 218 922			2 218 922
3.4 Revegetation for 2010				
3.4 Revegetation in the base year				

Abbreviation: Annex A sources = sources included in Annex A to the Kyoto Protocol.
[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustments.
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 12
Information to be included in the compilation and accounting database in t CO_2 eq for 2009

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for 2009				
CO_2	3 067 034 751			3 067 034 751
CH_4	296 084 939			296 084 939
N_2O	272 200 611			272 200 611
HFCs	66 040 246			66 040 246
PFCs	2 715 014			2 715 014
SF_6	6 081 306			6 081 306
Total Annex A sources	3 710 156 868			3 710 156 868
Activities under Article 3, paragraph 3, for 2009				
3.3 Afforestation and reforestation on non-harvested land for 2009	–46 786 574			–46 786 574
3.3 Afforestation and reforestation on harvested land for 2009	2 005 605			2 005 605
3.3 Deforestation for 2009	30 447 197			30 447 197
Activities under Article 3, paragraph 4, for 2009[c]				
3.4 Forest management for 2009	–228 901 498			–228 901 498
3.4 Cropland management for 2009	1 330 311			1 330 311
3.4 Cropland management for the base year	9 600 255			9 600 255
3.4 Grazing land management for 2009	–130 962			–130 962
3.4 Grazing land management for the base year	2 218 922			2 218 922
3.4 Revegetation for 2009				
3.4 Revegetation in the base year				

Abbreviation: Annex A sources = sources included in Annex A to the Kyoto Protocol.
[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustments.
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Table 13
Information to be included in the compilation and accounting database in t CO_2 eq for 2008

	As reported	*Revised estimates*	*Adjustment*[a]	*Final*[b]
Annex A emissions for2008				
CO_2	3 331 500 971			3 331 500 971
CH_4	301 796 688			301 796 688
N_2O	282 705 022			282 705 022
HFCs	62 767 536			62 767 536
PFCs	4 119 615			4 119 615
SF_6	6 420 771			6 420 771
Total Annex A sources	3 989 310 603			3 989 310 603
Activities under Article 3, paragraph 3, for 2008				
3.3 Afforestation and reforestation on non-harvested land for 2008	–43 924 609			–43 924 609
3.3 Afforestation and reforestation on harvested land for 2008	2 193 343			2 193 343
3.3 Deforestation for 2008	31 457 676			31 457 676
Activities under Article 3, paragraph 4, for 2008[c]				
3.4 Forest management for 2008	–233 029 292			–233 029 292
3.4 Cropland management for 2008	1 981 305			1 981 305
3.4 Cropland management for the base year	9 600 255			9 600 255
3.4 Grazing land management for 2008	–675			–675
3.4 Grazing land management for the base year	2 218 922			2 218 922
3.4 Revegetation for 2008				
3.4 Revegetation in the base year				

Abbreviation: Annex A sources = sources included in Annex A to the Kyoto Protocol.
[a] "Adjustment" is relevant only for Parties for which the expert review team has calculated one or more adjustments.
[b] "Final" includes revised estimates, if any, and/or adjustments, if any.
[c] Activities under Article 3, paragraph 4, are relevant only for Parties that elected one or more such activities.

Annex II

Documents and information used during the review

A. Reference documents

Intergovernmental Panel on Climate Change. *2006 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>.

Intergovernmental Panel on Climate Change. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>.

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories". FCCC/SBSTA/2006/9. Available at <http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>.

"Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention". FCCC/CP/2002/8. Available at <http://unfccc.int/resource/docs/cop8/08.pdf>.

"Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol". Decision 19/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=14>.

"Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol". Decision 15/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=54>.

"Guidelines for review under Article 8 of the Kyoto Protocol". Decision 22/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=51>.

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FCCC/ARR/2012/EU. Report of the individual review of the annual submission of the European Union submitted in 2012. Available at <http://unfccc.int/resource/docs/2013/arr/eu.pdf>.

Standard independent assessment report template, parts 1 and 2. Available at <http://unfccc.int/kyoto_protocol/registry_systems/independent_assessment_reports/items/4061.php>.

B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Velina Pendolovska (European Commission, Directorate-General for Climate Action), including additional material on the methodologies and assumptions used.

Annex III

Acronyms and abbreviations

AD	activity data
AWMS	animal waste management system
CH_4	methane
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
CSC	carbon stock change
DOC	degradable organic carbon
EF	emission factor
ERT	expert review team
EU ETS	European Union emission trading system
F-gas	fluorinated gas
FAO	Food and Agriculture Organization of the United Nations
$Frac_{PRP}$	fraction of livestock nitrogen excreted and deposited onto soil during grazing
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6 without GHG emissions and removals from LULUCF
HFCs	hydrofluorocarbons
IE	included elsewhere
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
ITL	international transaction log
kg	kilogram (1 kg = 1,000 grams)
kha	kilohectare
KP-LULUCF	land use, land-use change and forestry emissions and removals from activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol
LULUCF	land use, land-use change and forestry
MCF	methane correction factor
MSW	municipal solid waste
Mg	megagram (1 Mg = 1 tonne)
N_2O	nitrous oxide
NA	not applicable
NE	not estimated
NIR	national inventory report
NO	not occurring
PFCs	perfluorocarbons
PJ	petajoule (1 PJ = 10^{15} joule)
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	standard independent assessment report
UNFCCC	United Nations Framework Convention on Climate Change